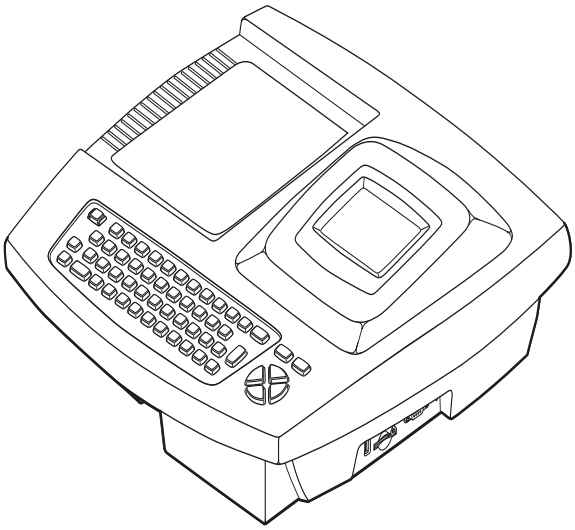
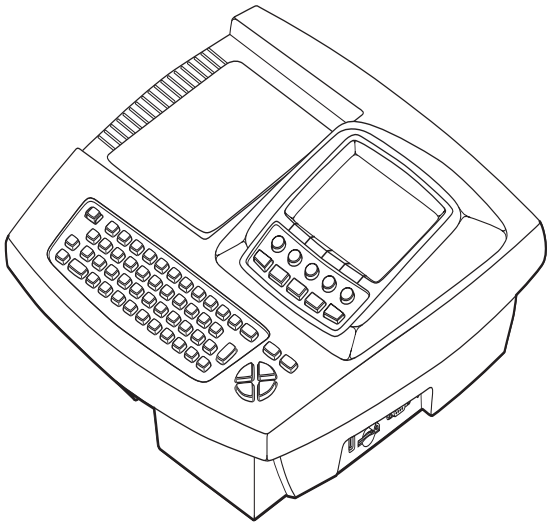
# CP 100 and CP 200™ 12-Lead Resting Electrocardiograph

CP 100™ 12- Lead Resting Electrocardiograph



CP 200™ 12- Lead Resting Electrocardiograph



## Service Manual

Welch Allyn®

Advancing Frontline Care™

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| European Call Center | +353 46 906 7790 | France | +33 15 569 5849 |
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# 1 Safety Summary

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# Introduction

The safety summary, and all additional specific warnings and cautions located throughout the documentation, must be read and understood by all users of the CP 100 and CP 200 Electrocardiograph.

# Symbols

The symbols illustrated on the following pages may appear on the electrocardiograph, the packaging, the shipping container, or in this manual.

**Documentation Symbols**

**WARNING** Indicates conditions or practices that could lead to illness, injury, or death.

**Caution** In the manual, indicates conditions or practices that could damage the equipment or other property.

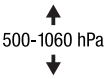
**Caution** On the product, means "Consult accompanying documentation."

**Shipping, Storing, and Environment Symbols**

This end up

Keep dry

Fragile




Altitude limits

Temperature limits

Relative humidity limit

**Certification Symbols**

Meets essential requirements of European Medical Device Directive 93/42/EEC

Complies with applicable U.S. and Canadian medical safety standards

European Regulatory Manager
Welch Allyn LTD.
Navan Business Park
Dublin Road
Navan, County Meath, Republic of Ireland
Tel.: 353-46-90-67700
Fax: 353-46-90-67756

Australian registered importer

## Operation Symbols

For details on the keys, see "Keyboard Functions" on page 14.

On/standby (off)

Navigation arrows

Enter

Auto ECG

Rhythm ECG

SD memory card slot


Alternating current

Dangerous voltage

Defibrulation-proof type CF applied parts (while the electrocardiograph is safety-rated "CF" for direct cardiac contact it is not intended to be connected directly to the patient's heart; only surface contact with the patient's skin is intended).

Do not reuse.

Type BF Defibrillator proof

Do not dispose of this product as unsorted municipal waste. Prepare this product for reuse or separate collection as specified by Directive 2002/96/EC of the European Parliament and the Council of the European Union on Waste Electronic and Electrical Equipment (WEEE). If this product is contaminated, this directive does not apply.

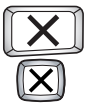
For more specific disposal information, see www.welchallyn.com/weee, or contact Welch Allyn Customer Service at +44 207 365 6780.

Help

Backspace

Shift

Menu


Stop/Cancel

Com port A (for patient cable)

Battery charge level


Direct current

Ground equipotential

Sealed lead-acid battery

Recycle

AC fuse replacement information

## Additional Operation Symbols for CP 200

Spirometry Key

Spirometry port

OK

Com port B (for USB cable)

# Servicing the Electrocardiograph Safely

Before using or servicing the electrocardiograph, you must read and understand the following safety-related information.

## General Warnings

The following warning statements apply to electrocardiograph use in general. Warning statements that apply specifically to particular procedures, such as connecting the patient cable or performing an ECG test, appear in the corresponding sections of the manual.

Warning statements indicate conditions or practices that could lead to illness, injury, or death.

### Warnings Related to the Environment

**WARNING** To avoid a possible explosion, do not use the electrocardiograph in the presence of flammable anesthetics.

**WARNING** When transporting the electrocardiograph on a cart, tuck the patient cable away from the wheels so that it does not present a hazard.

**WARNING** Do not use the CP 100 and CP 200 Electrocardiograph in an MRI suite or hyperbaric chamber.

**WARNING** Do not autoclave the CP 100 and CP 200 Electrocardiograph or patient cable.

### Warnings Related to Accessories and Other Equipment

**WARNING** For operator and patient safety, peripheral equipment and accessories that can come in direct patient contact must be in compliance with all appropriate safety, EMC, and regulatory requirements. See "EMC Guidance and Manufacturer's Declarations" on page 79

**WARNING** All signal input and output (I/O) connectors are intended for connection of only devices complying with IEC 60601-1, or other IEC standards (for example, IEC 60950), as appropriate to the device. Connecting additional devices to the electrocardiograph may increase chassis or patient leakage currents. To maintain operator and patient safety, consider the requirements of IEC 60601-1-1. Measure the leakage currents to confirm that no electric shock hazard exists.

**WARNING** The electrocardiograph has not been designed for use with high-frequency (HF) surgical equipment and does not protect against hazards to the patient.

**Warnings Related to Using the Electrocardiograph**

**WARNING** Avoid positioning any leads or cables so that they could easily trip someone.

**WARNING** Satisfactory maintenance procedures must be implemented, or equipment failure and health hazards may result.

**Warnings Related to Repairing the Electrocardiograph**

**WARNING** Only qualified service personnel should attempt to repair the electrocardiograph. In case of a malfunction, call Technical Support and precisely describe the problem. For phone numbers, see page ii.

**WARNING** While under warranty, the electrocardiograph must be serviced only by a Welch Allyn service technician.

**WARNING** Electrostatic discharge (ESD) can damage or destroy electronic components. Handle static-sensitive components only at static-safe workstation.

**WARNING** Consider all electrical and electronic components of the monitor as static-sensitive.

## Electrostatic Discharge (ESD)

CAUTION
SENSITIVE ELECTRONIC DEVICES
DO NOT SHIP OR STORE NEAR STRONG ELECTROSTATIC, ELECTROMAGNETIC, MAGNETIC OR RADIOACTIVE FIELDS.

Electrostatic discharge is a sudden current flowing from a charged object to another object or to ground. Electrostatic charges can accumulate on common items such as foam drinking cups, cellophane tape, synthetic clothing, untreated foam packaging material, and untreated plastic bags and work folders, to name only a few.

Electronic components and assemblies, if not properly protected against ESD, can be permanently damaged or destroyed when near or in contact with electrostatically charged objects. When you handle components or assemblies that are not in protective bags and you are not sure whether they are static-sensitive, assume that they are static-sensitive and handle them accordingly.

- Perform all service procedures in a static-protected environment. Always use techniques and equipment designed to protect personnel and equipment from electrostatic discharge.
- Remove static-sensitive components and assemblies from their static-shielding bags only at static-safe workstations—a properly grounded table and grounded floor mat—and only when you are wearing a grounded wrist strap (with a resistor of at least 1 megohm in series) or other grounding device.

- Use only grounded tools when inserting, adjusting, or removing static-sensitive components and assemblies.
- Remove or insert static-sensitive components and assemblies only with monitor power turned off.
- Insert and seal static-sensitive components and assemblies into their original static-shielding bags before removing them from static-protected areas.

Always test your ground strap, bench mat, conductive work surface, and ground cord before removing components and assemblies from their protective bags and before beginning any disassembly or assembly procedures.

## General Cautions

The following caution statements apply to electrocardiograph use in general. Caution statements that apply specifically to particular procedures, such as connecting the patient cable or performing an ECG test, appear in the corresponding sections of the manual.

Caution statements indicate conditions or practices that could damage the equipment or other property.

**Caution** When removing the electrocardiograph from storage, allow it to thermally stabilize to surrounding environmental conditions before using it.

**Caution** To prevent possible damage to the keypad, do not use sharp or hard objects to press keys. Only use fingertips.

**Caution** Do not expose the patient cable to strong ultra-violet radiation.

**Caution** Do not pull or stretch the patient cable. Doing so could result in mechanical or electrical failures. Form the patient cable into a loose loop before storing.

**Caution** Avoid positioning the patient cable where it might get pinched or stepped on. If the cable's impedance is altered, measurements might no longer be accurate, and repair might be necessary.

**Caution** Using the equipotential terminal for anything but grounding purposes may contribute to damage of the device.

**Caution** Use only parts and accessories supplied with the device and available through Welch Allyn. The use of accessories other than those specified may result in degraded performance of this device.

**Caution** Portable and mobile RF communications equipment can affect the performance of the electrocardiograph.

**Caution** Other medical equipment—including but not limited to defibrillators, ultrasound machines, pacemakers, and other stimulators—may be used simultaneously with the electrocardiograph. However, such devices may disturb the electrocardiograph signal.

# 2 Overview

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# Purpose and Scope

The service manual is a reference for periodic preventive maintenance and corrective service procedures for the Welch Allyn CP 100 and CP 200 Electrocardiograph.

Corrective service is supported to the level of field-replaceable units. This includes some circuit-board assemblies and some subassemblies, case parts, and other parts. See "Field Replaceable Parts" on page 69 for complete list of user-replaceable service parts.

**Note** Repair and replacement of the main board is not supported. All service work on the main board must be performed by certified and qualified service personnel at an authorized Welch Allyn service center.

**Caution** No component-level repair of circuit boards and subassemblies is supported. Use only the repair procedures described in this manual.

**WARNING** When performing a service procedure, follow the instructions exactly as presented in this manual. Failure to do so could damage the monitor, invalidate the product warranty, and lead to serious personal injury.

This guide provides troubleshooting information, assembly procedures, and instructions for functional testing and performance verification. It is intended for use only by technically qualified service personnel.

# Service Options

## Warranty Service

All repairs on products under warranty must be performed and/or approved by Welch Allyn. Refer all warranty service to Welch Allyn Factory Service or another authorized Welch Allyn Service Center. Obtain an RMA number for all returns to Welch Allyn Factory Service – see Returning Products (page 9).

**Caution** Unauthorized repairs will void the product warranty.

## Non-Warranty Service

Welch Allyn Factory Service and authorized Service Centers support non-warranty repairs. Contact any Welch Allyn regional service center for pricing and service options.

Welch Allyn offers modular repair parts for sale to support non-warranty service. This service must be performed only by qualified end-user biomedical/clinical engineers using this service manual.

The Welch Allyn Electrocardiograph Service Information supports certain service functions. *For information about any Welch Allyn product, please call Welch Allyn Technical Support: (page ii)*.

# Technical Support Services

Welch Allyn offers the following technical support services:

Telephone support
Loaner equipment
Service agreements
Replacement service parts
Factory Service

For information on any of these services, contact Welch Allyn at the numbers listed on page ii

# Returning Products

To return a product for service, contact Welch Allyn Technical Support and request a Return Material Authorization (RMA) number.

**Note** Welch Allyn does not accept returned products without an RMA.

- When requesting an RMA, please have the following information available:
- Product name, model number, and serial number
- A complete return shipping address, including a contact name and phone number; include any special shipping instructions
- A purchase-order number or credit-card number if the product is not covered by warranty
- A full description of the problem or service request

To ship the unit, please observe these packing guidelines:

- Remove from the package all hoses, connectors, cables, sensors, power cords, and other ancillary products and equipment, except those items that might be associated with the problem.
- Use the original shipping carton and packing materials, or as close an approximation as possible.
- Include a packing list.
- Write the Welch Allyn RMA number with the Welch Allyn address on the outside of the shipping carton.

United States federal regulations require that any unit received by Factory Service must be free from blood-borne pathogens before processing. All incoming products are cleaned as well as possible, but products that cannot be effectively cleaned cannot be accepted for repair. Please thoroughly clean all organic residues from the product before shipment. This will ensure safe receipt, processing and repair, and will help expedite the return of your device.

# Product Configurations

Model numbers for the configurations are as follows:

| Model Number | Description |
|---|---|
| CP 1 | CP 100 Electrocardiograph |
| CP 1A | CP 100 Electrocardiograph w/Interpretation |
| CP 2 | CP 200 Electrocardiograph |
| CP 2A | CP 200 Electrocardiograph w/Interpretation |
| CP 2S | CP 200 Electrocardiograph w/Spirometry |
| CP 2AS | CP 200 Electrocardiograph w/Interpretation & Spirometry |

# Recommended Service Intervals

| Interval or Condition | Action Recommended | Procedure |
|---|---|---|
| Every 6 – 24 months (per hospital protocols) | Complete Functional test | Functional Verification (page 29) |
| Battery does not hold a charge | Check battery capacity<br>Replace battery | Battery Accuracy Test (page 31)<br>Replacing the Battery or Fuse (page 58) |
| Unit has been dropped or otherwise damaged | Complete Functional test | Functional Verification (page 29) |
| Unit malfunctioning | Complete Functional test | Functional Verification (page 29) |
| Unit does not pass Functional Verification | Troubleshooting and repair followed by functional test<br><br>Return to authorized service center | Troubleshooting (page 41)<br>Disassembly and Repair Procedures (page 47)<br>Functional Verification (page 29)<br><br>Returning Products (page 9) |

# Controls, Indicators, and Connectors

This section describes the controls, indicators, and connectors that are part of the electrocardiograph.

**Figure 1. Top of CP 200 Electrocardiograph**

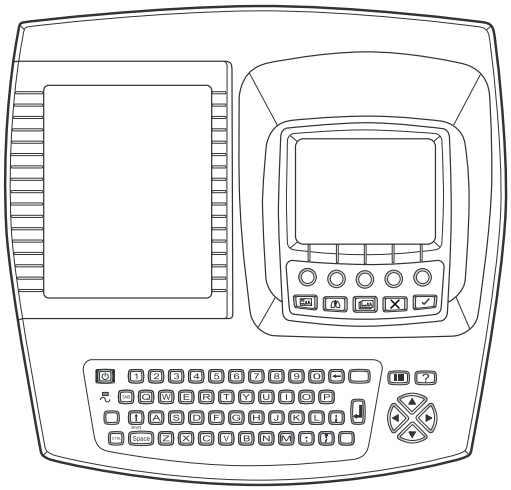



**Figure 2. Top of CP 100 Electrocardiograph**

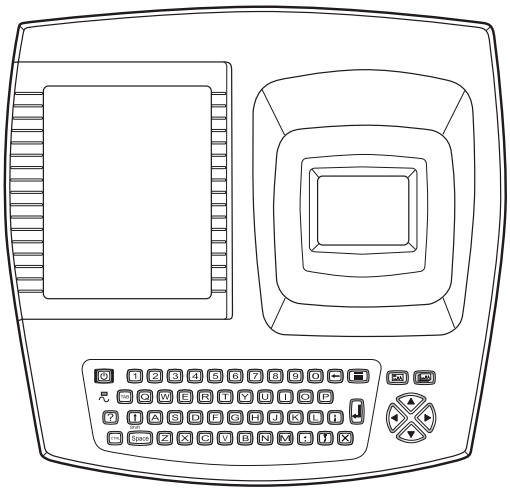


**Figure 3. Back of Electrocardiograph**

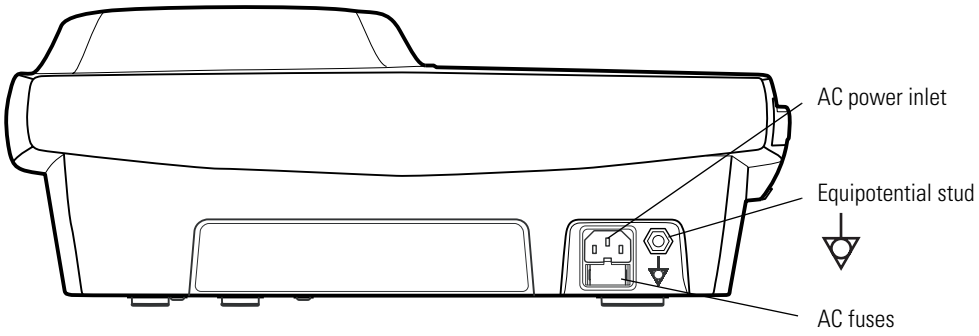



**Figure 4. Right Side of Electrocardiograph**

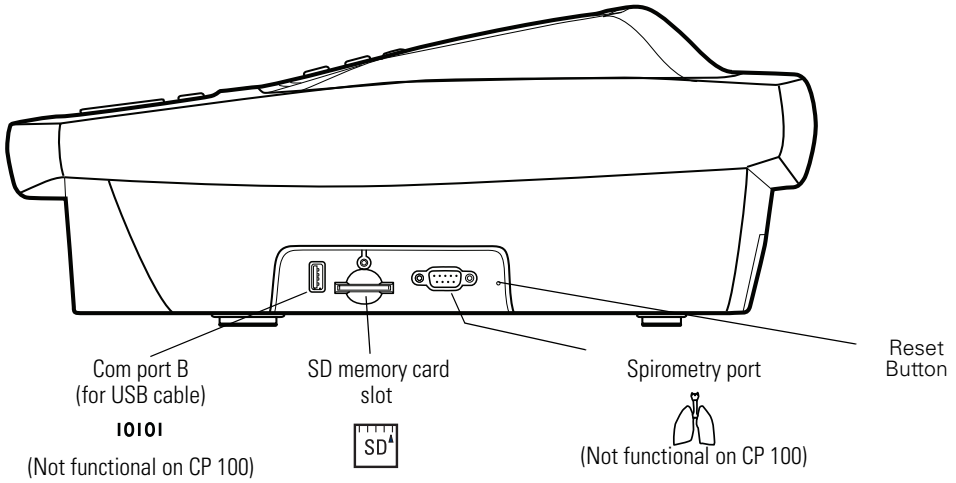



**Figure 5. Left Side of Electrocardiograph**

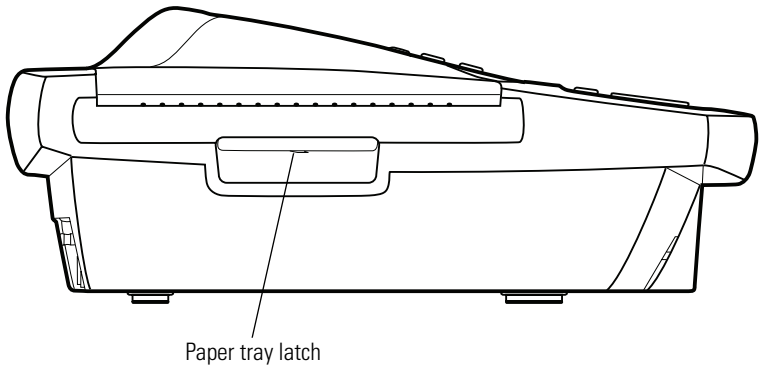


**Figure 6. Front of CP 200 Electrocardiograph**

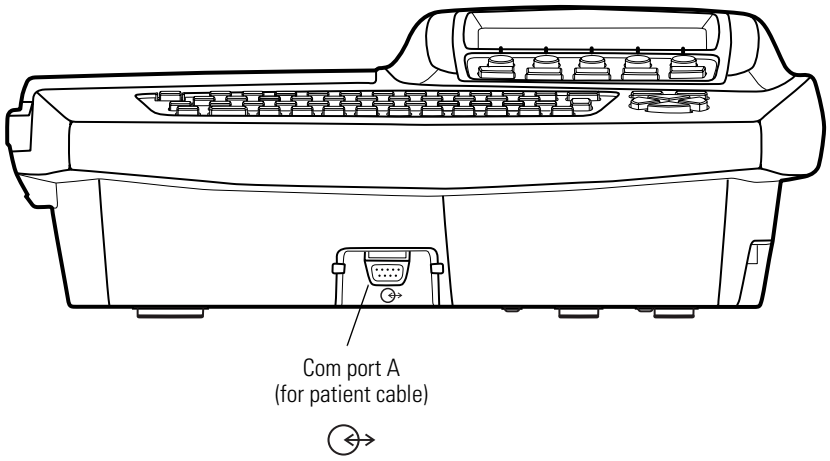
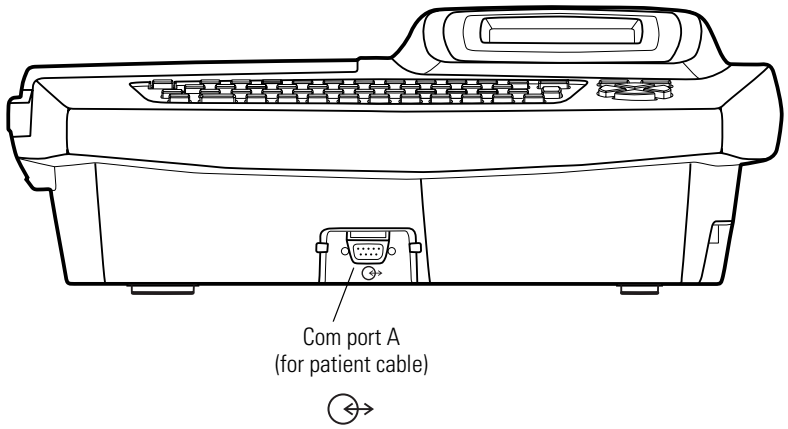



**Figure 7. Front of CP 100 Electrocardiograph**



## Keyboard Functions

**Figure 8. Keyboard for CP 200 Electrocardiograph**

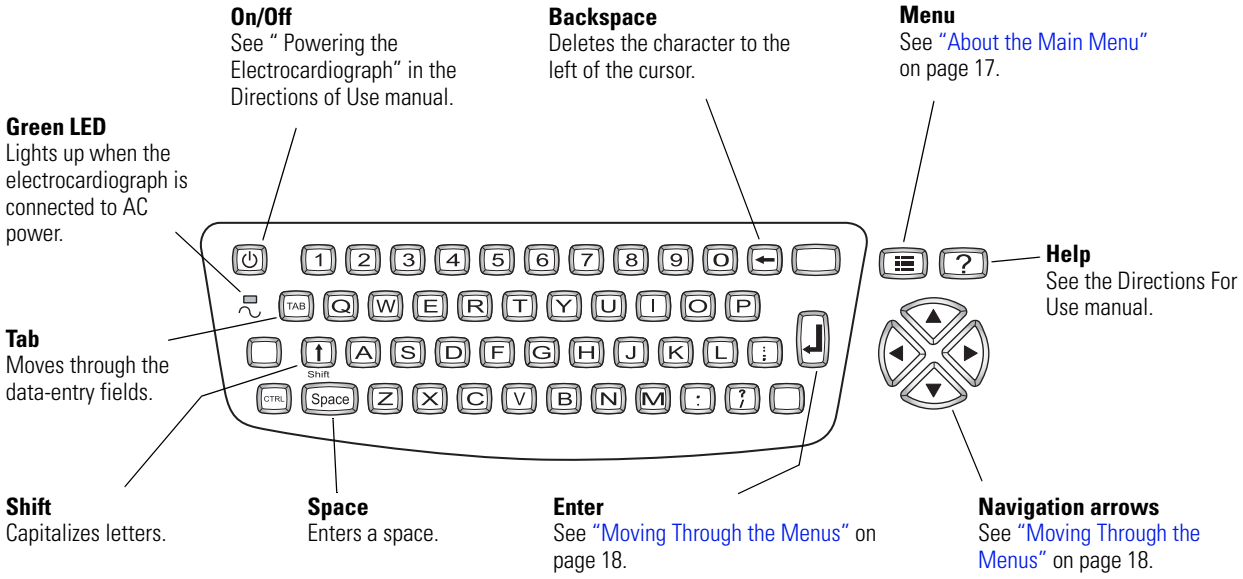

**On/Off**
See " Powering the Electrocardiograph" in the Directions of Use manual.
**Backspace**
Deletes the character to the left of the cursor.
**Menu**
See "About the Main Menu" on page 17.
**Green LED**
Lights up when the electrocardiograph is connected to AC power.
**Help**
See the Directions For Use manual.
**Tab**
Moves through the data-entry fields.
**Shift**
Capitalizes letters.
**Space**
Enters a space.
**Enter**
See "Moving Through the Menus" on page 18.
**Navigation arrows**
See "Moving Through the Menus" on page 18.

**Figure 9. Keyboard for CP 100 Electrocardiograph**

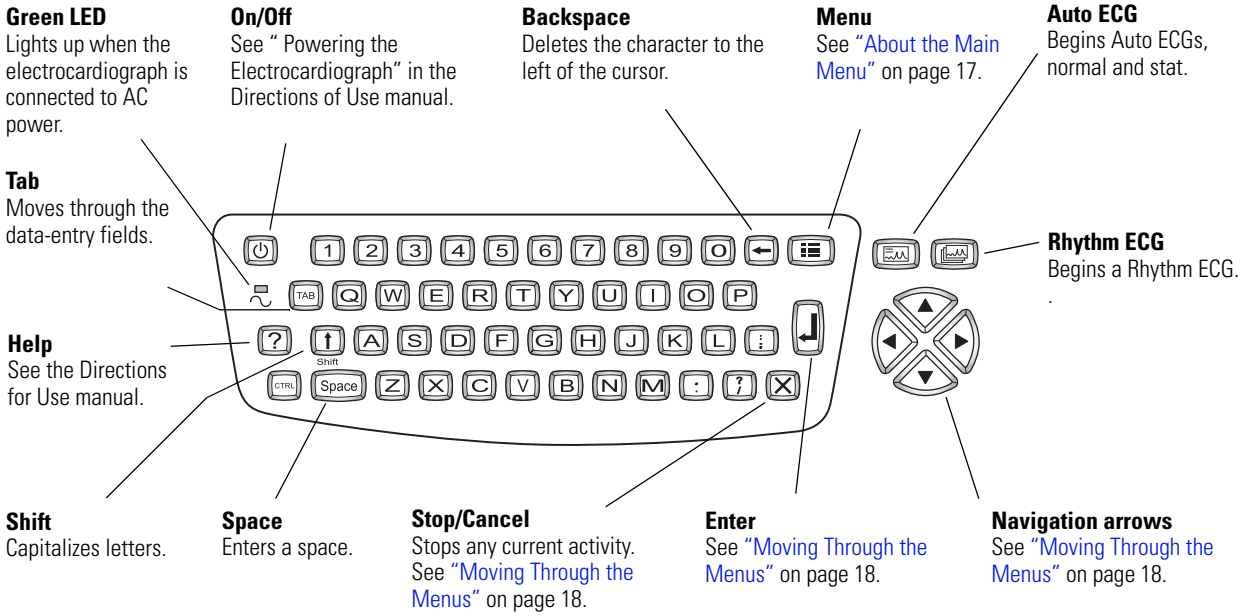
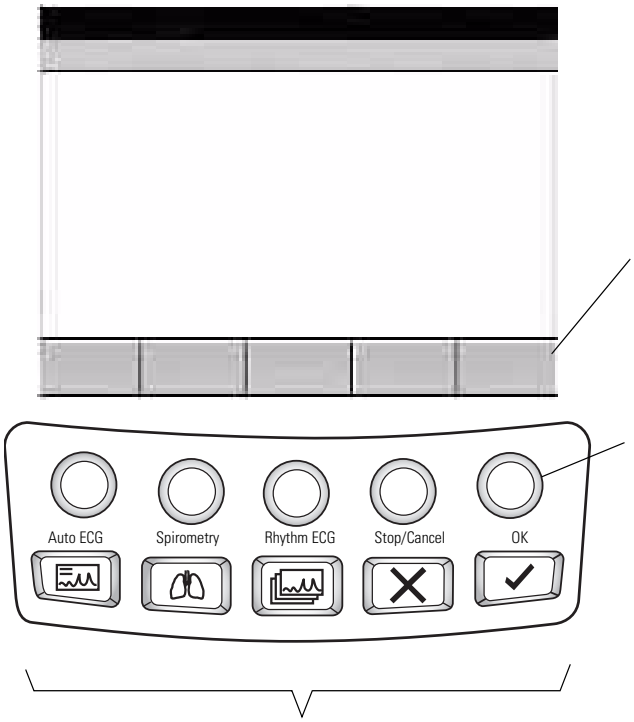

**Green LED**
Lights up when the electrocardiograph is connected to AC power.
**On/Off**
See " Powering the Electrocardiograph" in the Directions of Use manual.
**Backspace**
Deletes the character to the left of the cursor.
**Menu**
See "About the Main Menu" on page 17.
**Auto ECG**
Begins Auto ECGs, normal and stat.
**Tab**
Moves through the data-entry fields.
**Rhythm ECG**
Begins a Rhythm ECG.
.
**Help**
See the Directions for Use manual.
**Shift**
Capitalizes letters.
**Space**
Enters a space.
**Stop/Cancel**
Stops any current activity. See "Moving Through the Menus" on page 18.
**Enter**
See "Moving Through the Menus" on page 18.
**Navigation arrows**
See "Moving Through the Menus" on page 18.

**Figure 10. Softkeys and Function Keys for the CP 200 Electrocardiograph**




**Softkeys**
These softkeys display text or images that correspond to the unlabeled buttons below them. The content changes from screen to screen.

**Softkey buttons**
These buttons activate the functions displayed above them. If a softkey is blank, pressing its button has no effect.

**Function Keys**

**Auto ECG**
Begins Auto ECGs, normal and stat.

**Spirometry**
Begins spirometry tests.
See spirometry manual.

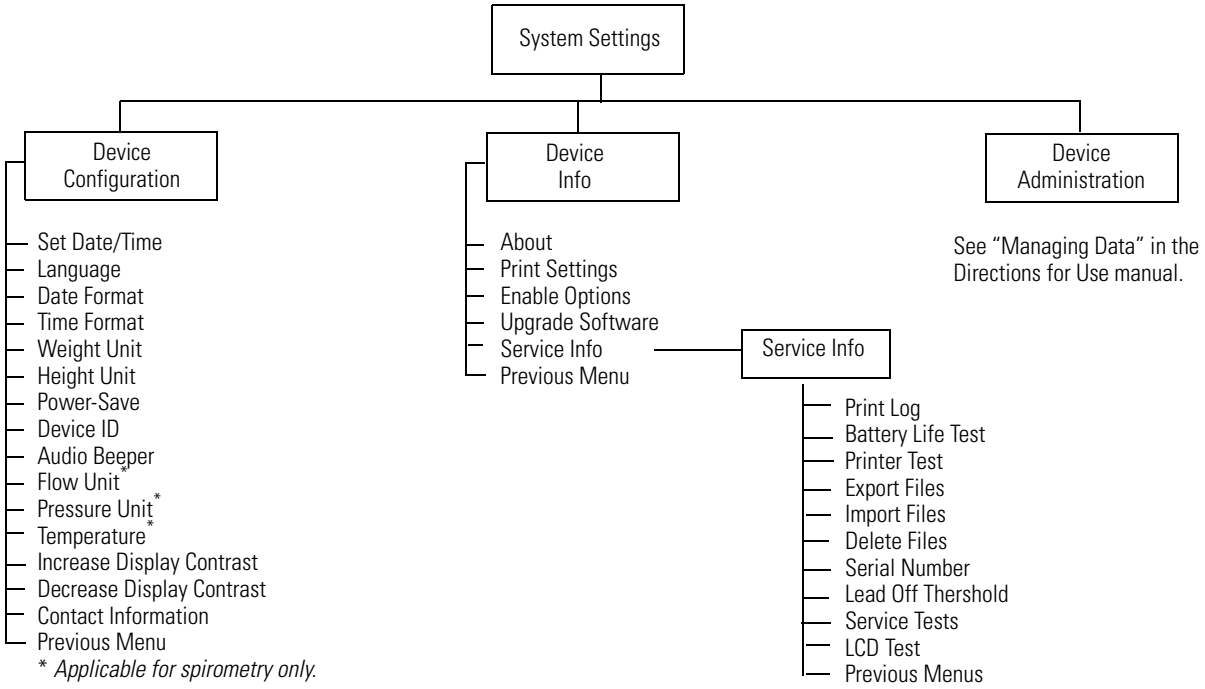
**Rhythm ECG**
Begins Rhythm ECGs.

**Stop/Cancel**
Stops any current activity.
See "Moving Through the Menus" on page 18.

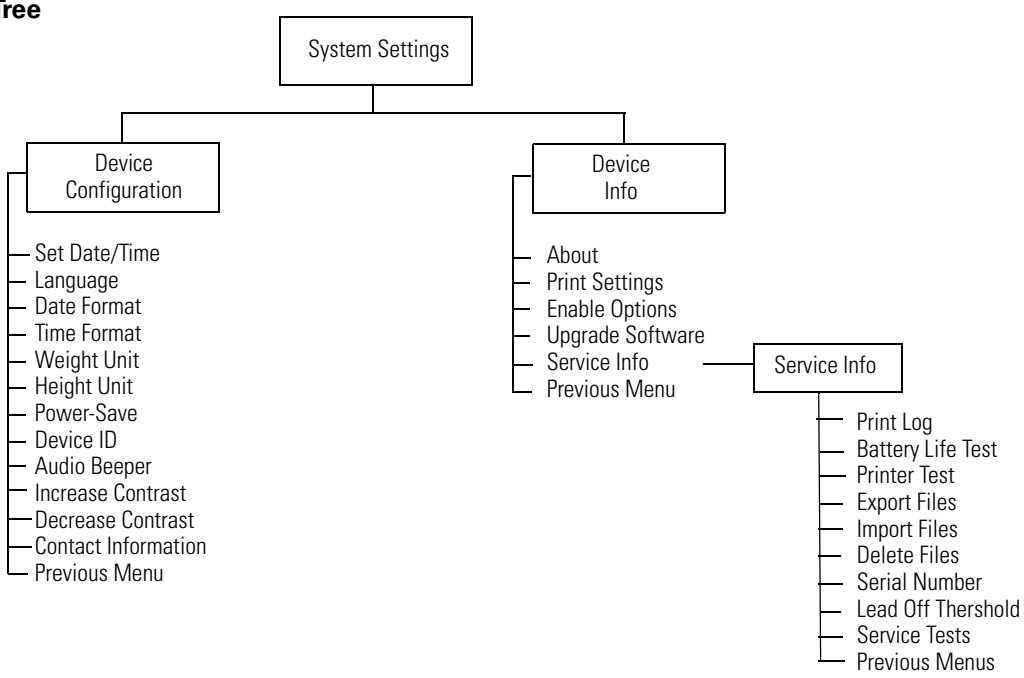
**OK**
Accepts data that you have entered, or chooses a highlighted item.
See "Moving Through the Menus" on page 18.

# "System Settings" Menu Tree

### CP 200 Menu Tree




### CP 100 Menu Tree



# About the Main Menu

The main menu appears when you press the Menu key .

**Figure 11. Main Menu CP 200**

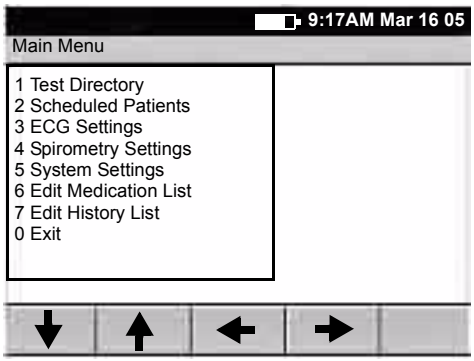
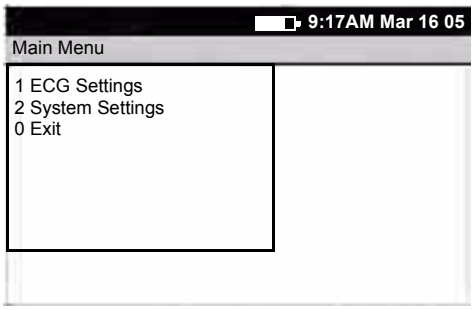



**Figure 12. Main Menu CP 100**




| Submenu | Purpose | Procedure |
|---|---|---|
| Test Directory | View, change, print, or send saved tests. (CP 200 Only) | See the *Directions for Use* manual on your specific model. |
| Scheduled Patients | View the scheduled patients list, add patients to the list, or delete patients from the list. (CP 200 Only | See the *Directions for Use* manual on your specific model. |
| ECG Settings | Review or change ECG settings: Auto Report format, Rhythm Report format, and so on. | See the *Directions for Use* manual on your specific model. |
| Spirometry Settings | Review or change spirometry settings: display settings, print settings, and so on. (CP 200 Only | See the *Directions for Use* manual on your specific model. |
| System Settings | Review or change system settings: device configuration, device info, user setup, and so on. | See the *Directions for Use* manual on your specific model. |
| Edit Medication List | Edit the list of medication choices available to choose during patient data entry. (CP 200 Only | See the *Directions for Use* manual on your specific model. |
| Edit History List | Edit the list of clinical conditions available to choose during patient data entry. (CP 200 Only | See *CP 200 Electrocardiograph Directions for Use* manual. |

# Moving Through the Menus

**Figure 13. CP 200 Standard Menu**

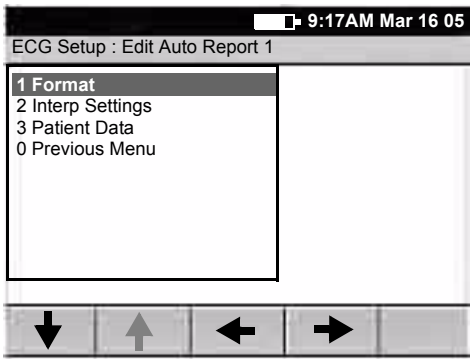



**Figure 14. CP 100 Standard Menu**

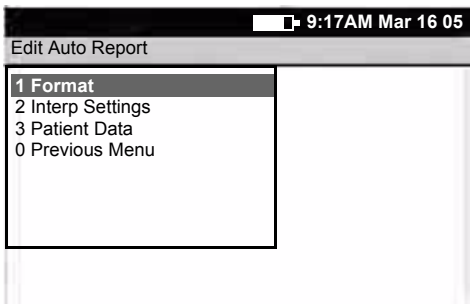



**Figure 15. CP 200 Parent Menu With Submenu**

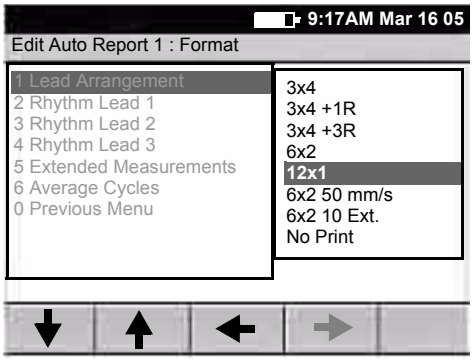
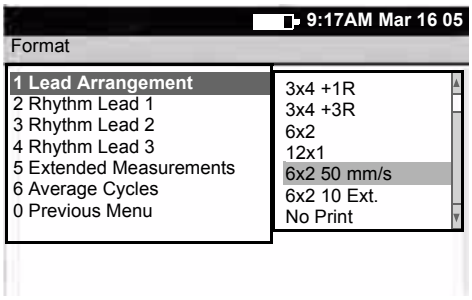



**Figure 16. CP 100 Parent Menu with Submenu**




| Desired Actions | Keys to Press |
|---|---|
| To move up or down a list | ▲ or ▼ (keyboard or softkey arrows) |
| To open a standard menu (Figure 13)<br><br>To move from parent menu to submenu on same screen (Figure 15) | or or ▶ or item's number or letter |
| To perform an action<br>To accept data<br>To check or uncheck a checkbox | or |
| To return to parent menu from submenu on same screen (Figure 15) | or (To select the highlighted submenu item.)<br><br>or ◀ (To make no change.) |
| To move back through the menus | ◀ or zero key |
| To move through data-entry fields | TAB |
| To return to the "Main Screen" from a standard menu (Figure 13) | |

**Note** Keyboard and softkey arrows work the same way.

# Reviewing the Device Information

1. Press the Menu key .
2. Choose **System Settings** > **Device Info**.

   The following screen appears.

**Figure 17. "Device Info" CP 200 Screen**

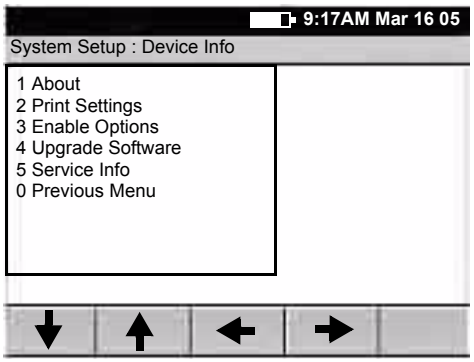
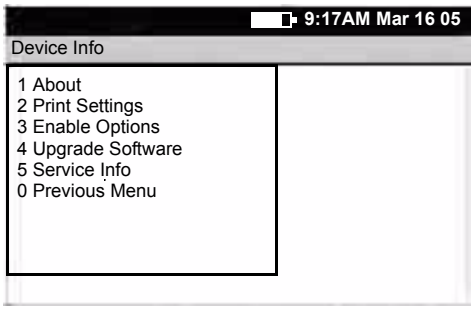



**Figure 18. "Device Info" CP 100 Screen**




3. Select the desired item:

| Item | Description |
|---|---|
| About | Displays the following information about the electrocardiograph:<br>• serial number<br>• modules configured<br>• version numbers |
| Print Settings | CP 200 = Prints your ECG, spirometry, and system settings as well as medication & history lists.<br>CP 100 = Prints your ECG and system settings. |
| Enable Options | Contact Technical Support. For phone numbers, see page ii. |
| Upgrade Software | Contact Technical Support. For phone numbers, see page ii. |
| Service Info | Accessible to service support only. See Service Menus (page 20) |

# CP 100 and CP 200 Electrocardiograph

## Service Menus

### Entering the Service Info Screen

This menu is password protected and only Welch Allyn Authorized Technician can access the Service Menus,)

**CP 200 Service Info Screen Procedure**

1. Power ON unit.
2. Press Menu key.
3. Choose **System Setting> Device Info> Service Info**

   The **"UserLogin"** screen appears. See Figure 19**.**

   Use the "Tab" or "Arrow" keys to move the cursor from field to field.

   Enter the following:
   User ID: **Service** (case sensitive)
   Password:**normser** (case sensitive)
4. Press **"Done"** using the softkey. Do not use the"Enter" key.

   The "Service Info" screen appears see Figure 20

**Figure 19. CP 200 "User Login"**

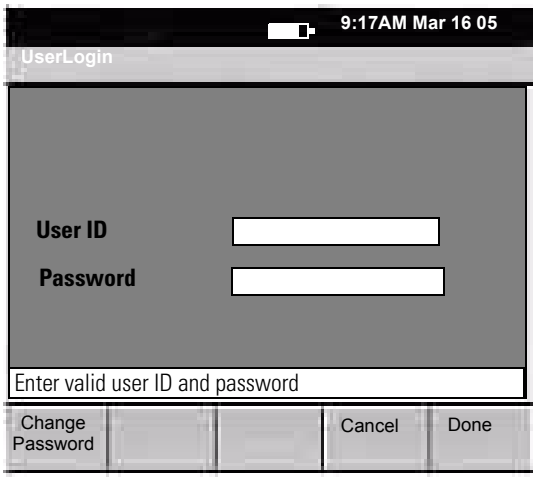
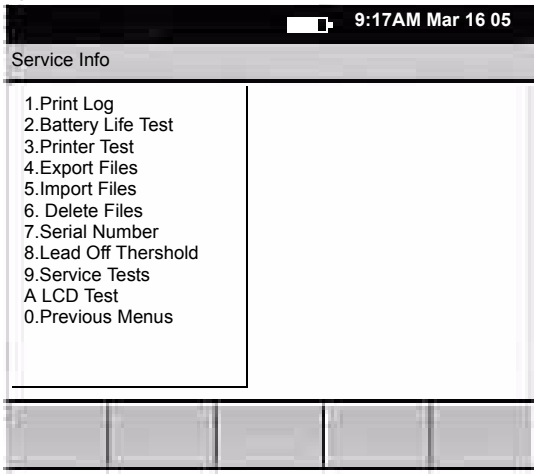



**Figure 20. CP 200 "Service Info" Screen**



### CP 100 Service Info Screen Procedure

1. Power ON unit.
2. Press Menu key.
3. Choose **System Setting** > **Device Info** > **Service Info**

   The **"UserLogin"** screen appears. See Figure 21**.**

   Use the "Arrow" keys to move the cursor from field to field.

   Enter the following:
   User ID: **Service** (case sensitive)
   Password:**normser** (case sensitive)

4. Highlight **"Done"** using the down arrow key.
5. Press "**Enter**" key.

   The "Service Info" screen appears. See Figure 22

**Figure 21. CP 100 "UserLogin" Screen**

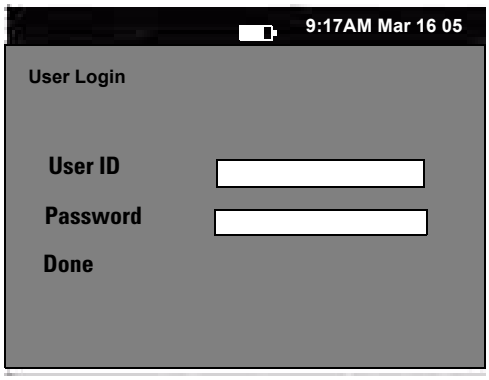
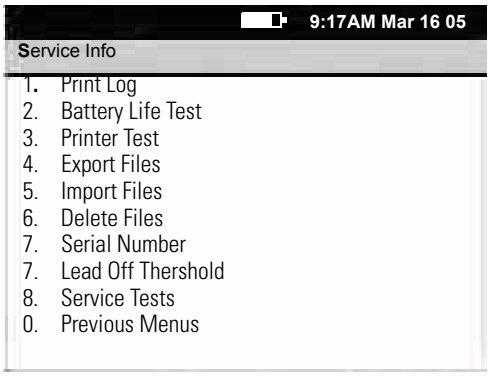



**Figure 22. CP 100 "Service Info" Screen**

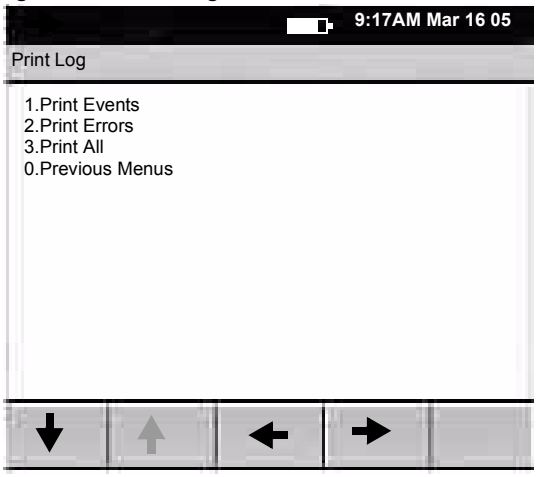



# Print Log

**Caution** These printouts can be very long. Only use the printouts if necessary. To stop the printouts press Stop/Cancel.

| Function | Description |
|---|---|
| Print Events: | This prints all events stored in the unit in descending order by date and time. Used for development of the software. Has no Service value. |
| Print Errors: | This prints any errors that occurred in the unit, in descending order by date and time, during normal operation. This can be valuable to use when the end-user says he/she has been having problems. |
| Print All: | This prints the Print Events and Print Errors as described above. |

**Figure 23. "Print Log" Screen**



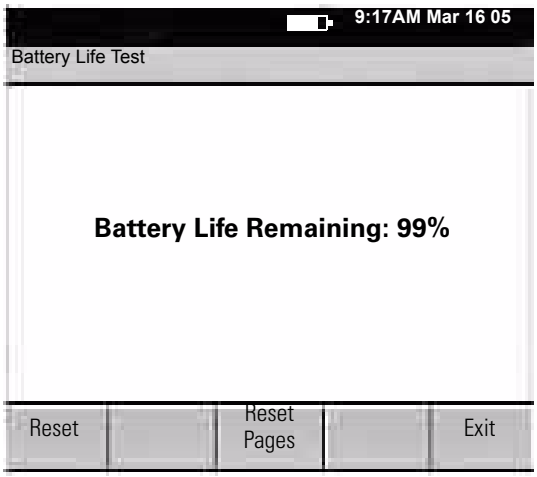
# Battery Life Test

This displays the percentage of battery life remaining on the battery, based on the number of charges it has incurred. This percentage approximates the life left in the battery based on this information.

**Caution** Only reset when the battery has been replaced and charged for at least 12hrs continuously.

| Function | Description |
|---|---|
| Reset | Resets the battery life to 100%. This is used only when the battery has been replaced |
| Reset Pages | Resets page count for the number of prints made on the printer. Should only be reset when print head has been replaced. |

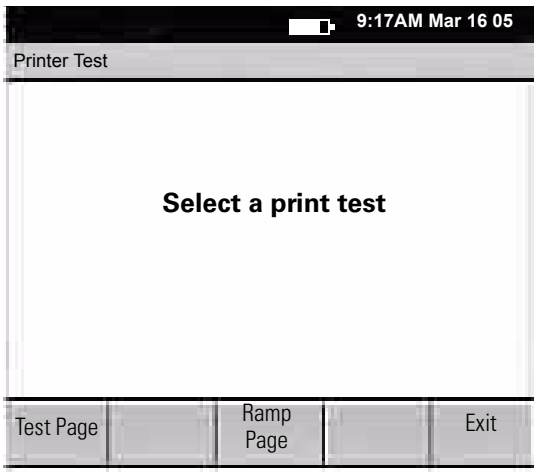
**Figure 24. "Battery Life Test" Screen**




# Printer Test

| Function | Description |
|---|---|
| Test Page | Prints a test page which repeats until the "Cancel" button is pressed. Refer to Functional Verification test for explanation. See Printer Test (page 35). |
| Ramp Test | Prints a one page ramp test. Refer to Functional Verification test for explanation. See Printer Test (page 35). |

**Figure 25. Printer Test" Screen**



# Export Files

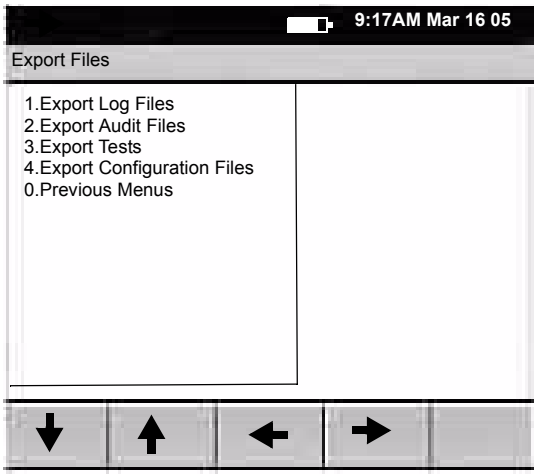
Use the "Export Files" function when the Main PCB is replaced, to reinstall the customer's saved ECG information and spirometry (CP 200 Only) or the unit's original configuration after repair.

**Caution** The tests exported to the SD memory card contain patients' medical information and should be treated the same as any confidential medical information.

**Note** If you are performing all functions you only need one SD memory card. Use a formatted blank SD memory card installed in the unit for each function.

| Function | Description |
|---|---|
| Export Log Files | Exports the Event log to a SD memory card in a folder called Log. Once complete, a message appears at bottom of the screen stating if the export was successful or not. |
| Export Audit Trail (CP 200 ONLY) | Exports the audit information of the unit to a SD memory card in a folder called Audit. Once complete a message appears at bottom of screen stating if export was successful or not.<br><br>Note: Audit information is available if Audit trail is turned on in Device Administration. See the *CP 200 Directions for Use* manual |
| Export Tests (CP 200 ONLY) | Exports all tests in the memory to a SD memory card in a folder called Tests for importing after repair. |
| Export Configuration Files: | Exports the configuration of the unit (i.e. print formats, patient data settings, logins, etc.) to a SD memory card in a folder called Config for importing after repair. |

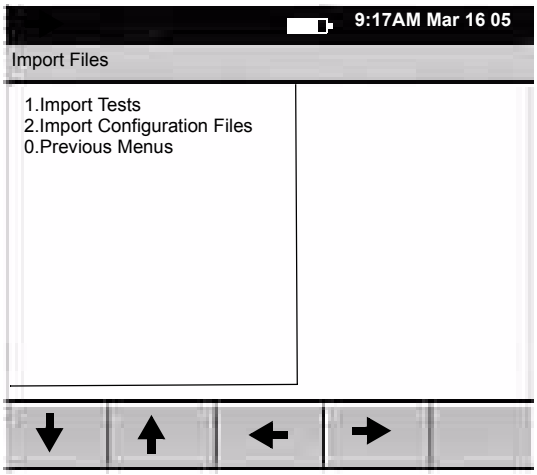
**Figure 26. "Export Files" Screen**



# Import Files

| Function | Description |
|---|---|
| Import Tests (CP 200 ONLY)* | Imports previously exported tests from the SD memory card.<br><br>*Before importing tests, you must delete the previous copies from the unit using the "Delete Files" menu. |
| Import Configuration Files | Imports previously exported configuration files from SD memory card.<br><br>After the import configurations files process is complete, the screen displays a reset prompt. Press any key to reset, and then follow the prompts to set the date and time. |

**Figure 27. "Import Files" Screen**

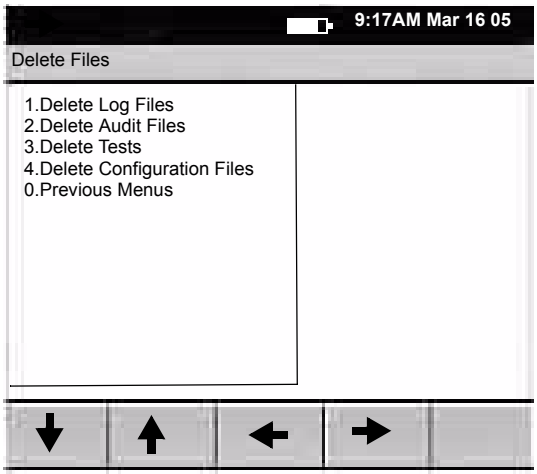



# Delete Files

**Caution** No warning is displayed when you delete files/tests.

| Function | Description |
|---|---|
| Delete Log Files | Deletes log files (event and error) from unit. |
| Delete Audit Files: (CP 200 ONLY) | Deletes the Audit Log file from the unit. |
| Delete Tests: (CP 200 ONLY)* | Deletes ALL saved ECG and Spirometry tests in memory. |
| Delete Configuration Files: | Deletes the Configuration files from the unit. |

**Figure 28. "Delete Files" Screen**




**Note** *Before importing the tests file, you must delete any previous tests from the unit using the "Delete Files" menu.

You do not have to delete the Configuration files on the unit before importing a Configuration files from SD memory card. All previous Configurations Files on the unit will be overwritten during the importing process.

## Serial Number

Used to enter the S/N of the unit after a Main Board has been replaced.

**Note** For use by Welch Allyn Authorized Repair facilities.

## Lead Off Threshold

The Lead Off Threshold setting provides a mechanism to increase/decrease the sensitivity of the device to lead impedance. Lead impedance is the electrical resistance of a lead. Lead impedance can rise if there is poor electrode/skin contact. As lead impedance rises, the input signals become imbalanced, resulting in a poor quality signal.

If the lead impedance for any of the leads is above the threshold, the device replaces the poor quality signal received from the patient cable with a square wave to indicate to the user that the affected signals are not usable. The lead impedance of each of the leads is independent, but there is a single threshold value. The threshold can be any of 15 values, from 1 (lowest threshold) to 15 (highest threshold). The default threshold is 7. If the threshold is changed to 1, it causes Lead Off all of the time, and setting it to 15 causes the leads to never appear "Off"

| Function | Description |
|---|---|
| Lead Off Threshold | The Lead Off Threshold setting is provided to diagnose problems with the front end. By increasing the Lead Off Threshold setting, the device accepts higher impedance signals, instead of replacing them with square waves. Although the device displays poorer quality signals, they may be unsuitable for diagnostic purposes, because they could be significantly distorted.<br><br>The Default setting for the Lead Off Threshold to 7<br><br>**To access and change the Lead Off Threshold**<br><br>Select **Main Menu** > **Service Info** > **Device Info** > **Lead Off Threshold** |

## Service Tests

Only authorized Welch Allyn Authorized Technicians are to perform the service tests.

**Note** To exit any of the applications press the "Enter" or"OK" key.

| Function | Description |
|---|---|
| CPWSTEST.EXE | Used to help troubleshoot USB issues.<br>**Enable USB**: Turns USB port on to be recognized by computer.<br><br>**Disable USB:** Turns USB port off so it is not recognized by computer. |
| MEANSMDWTESTER.EXE: | Strictly used for development purposes. |

| Function | Description |
|---|---|
| MMCSDTEST.EXE: | Used to test the SD memory card write/read function of the unit. Can also be used to test an SD memory card for problems.<br>**GO**: Starts the SD memory card test by pressing "G"<br>**STOP:** Stops the SD memory card test by pressing "S"<br>**ERASE ALL:** Erases all files written by this tester by pressing "E"<br>**Card Present:** If checked the unit detects the SD memory card inserted.<br>**Write Protect:** If checked the unit detects the lock is enabled on the SD memory card.<br>**Pulse:** Flashes when test is active<br>**Note:** Once the test is started it runs continuously. Press the "S" key to stop the test. |
| NORMANDY.EXE: | Used to return to the ECG program. |
| NORMTESTER.EXE | Strictly used for development purposes. |
| PPPTEST.EXE | Strictly used for development purposes. |
| PPPTEST2.EXE | Used to see battery and charger status/state. There are a number of selections on this screen. Listed below are the most commonly used functions. To activate a selection press the letter that coincides with the selection.<br>**Real-time:** Activates a real-time monitoring of the readings from the battery circuit.<br>**Battery Voltage:** Unplugged from AC this reflects the Voltage of the battery in millivolts; plugged into AC this reflects the charge voltage in millivolts.<br>Fast charge = 6800 – 7300<br>Trickle charge = 6300 – 6800<br>**Battery Current:** Indicates charge current in mA when charger is on.<br>**Charger State:** Indicates if charge circuit is on or off<br>**Charge State:** Indicates if the Fast Charge is on or off<br>**Fast Charge On:** Turns fast charge on. If battery is fully charged the sensing circuit can work against you. It only changes the reading for a brief second before switching back.<br>**Fast Charge Off:** Turns fast charge off.<br>**Charger On:** Turns charger on when plugged into AC.<br>**Charger Off:** Turns charger off. |

| Function | Description |
|---|---|
| PPPTEST3.EXE | Used to see printer assembly status/state. There are a number of selections on this screen. Listed below are the most commonly used functions. To activate a selection press the letter that coincides with the selection.<br>**Real-time:** Activates a real-time monitoring of the readings from the printer assembly.<br><br>**+24 V State:** Status of voltage applied to printhead for printing. Only turns on when motor is on.<br><br>**Step Motor State:** Status of paper drive motor.<br><br>**Paper Exhaust State:** Status of paper in unit.<br><br>**OK** indicates paper is loaded.<br>**Exhausted** indicates out of paper.<br><br>**Paper Status:** 'JAM' indicates printer was unable to feed paper and detect a cue mark in the required time. 'OK' indicates no jam.<br><br>**Door State:** This is equivalent to the Paper Exhaust State. There is no separate door sensor/switch.<br><br>**Printhead Temperature State:** State of printhead temperature. If temperature is too high, the printer does not print.<br><br>**Printhead Temperature (C):** Indicates temperature of the printhead in Celsius.<br><br>**Turn ON Motor:** Turns stepper motor on to drive paper.<br><br>**Turn OFF Motor:** Turns stepper motor off. |
| PPPTEST4.EXE | Used to see printer Assembly status/state. There are a number of selections on this screen. Listed below are the most commonly used functions. To activate a selection press the letter that coincides with the selection.<br>**Real-time:** Activates a real-time monitoring of the readings from the printer assembly.<br><br>**Feed to Next Page:** Advances paper to next page.<br><br>**Set Speed to 10 mm/s:** Sets paper speed to 10mm/s.<br><br>**Set Speed to 25 mm/s:** Sets paper speed to 25mm/s.<br><br>**Set Speed to 50 mm/s:** Sets paper speed to 50mm/s.<br><br>**Turn On Motor:** Turns stepper motor on to drive paper.<br><br>**Turn Off Motor:** Turns stepper motor off.<br><br>**Get Paper Registration State:** Indicates if the sensor has identified the installed paper. Note: If you open the door and close it, you must feed the paper to next page so unit can detect a cue mark. When the unit detects a cue mark, the state changes to YES.<br><br>**Get Cue Levels:** Indicates sensing level for the cue sensor for different paper states.<br>**< 10:** Indicates paper door open or out of paper.<br>**10 - 90:** Indicates cue sensor over a paper cue mark.<br>**> 190:** Indicates cue sensor over white paper. |

# 3 Functional Verification

Functional Verification Overview . . . . . 30
Full Functional Check . . . . . 30
Equipment Required . . . . . 30
Checklist and Test Results Report Form . . . . . 40

# Functional Verification Overview

This section describes the procedure for a complete functional test to support recommended preventive-maintenance schedules.

A checklist of the functional tests is provided on page 40. It is recommended that you print a copy of the checklist each time you perform the functional verification procedure, so you can record and save the test results. If the electrocardiograph ever requires service, the records of test results often facilitate troubleshooting.

Functional verification does not require opening the device case.

# Full Functional Check

**WARNING** Only qualified service personnel should perform a full functional checkout procedure.

Whenever the electrocardiograph is serviced or problems are suspected, Welch Allyn recommends a Functional Check.

# Equipment Required

| Commercially Available General-purpose/Medical Test Equipment | |
|---|---|
| **Item** | **Manufacturer** |
| Power Supply | Variable, 0 – 8 VDC, 5.0A (minimum), with voltage and current indicators |
| AC withstand voltage (hi-pot) tester | Associated Research 3605 or equivalent |
| Electrical Safety Analyzer w/ECG | Fluke DNI 232D or equivalent |
| Computer | PIII or better, CardioPerfect installed, available USB port |
| SD Memory Card | 64Mb or Greater |
| USB Cable | A – A type (WA P/N 401435) |
| Spirometry Dongle | Serial Version (W/A P/N 703552) |

## Operating/Non-Printing Mode Current Test

When the unit is powered on, the AC is disconnected and the LCD on, the unit's current is:

| CP 100 Current | CP 200 Current |
|---|---|
| 125 to 250 mA @ 6.4V DC ± .05 | 675 to 825 mA @ 6.4V DC ± .05 |

1. Unplug unit from line power
2. Connect a DC power supply, adjusted for 6.4V DC ± .05, in place of the battery.
3. Verify the current draw is within limits as indicated for unit after powering the unit up.

## Battery Accuracy Test

When a voltage of 6.2 ± 0.05 VDC is supplied to the unit battery terminals, and the AC is disconnected from the unit, the unit reports a "Normal to High" voltage.

When a voltage of 5.45 ± 0.05VDC is supplied to the unit battery terminals, and the AC is disconnected from the unit, the unit reports a "critically low" voltage.

**Note** The unit may have a 5 to 10 second delayed response.

1. Unplug unit from line power.
2. Connect a DC power supply in place of the battery.
3. Adjust power supply to 6.2VDC.
4. Turn the unit on, and then verify the unit does not indicate a low or critically low battery.
5. Adjust power supply to 5.45 VDC.
6. Verify the unit indicates a critically low power and will shut down.

## Sleep/Standby Mode Current Test

When the unit is powered on and the AC is disconnected, and the unit is in low power standby mode, the unit's current is:

| CP 100 Current | CP 200 Current |
|---|---|
| < 5 mA | < 5 mA |

1. Unplug the unit from line power and adjust the power supply to 6.4V DC ± .05.
2. Connect the DVM in series with the positive battery connection from the power supply.
3. Press the on/standby button.
4. Verify the LCD turns off and that the current draw is less than indicated for the unit.
5. Disconnect the power supply.

**Note** There may be up to a 10 sec delay in the drop of current due to the progressive hibernation mode.

## Charger Detect Test

1. Connect a DVM to the battery harness while observing correct polarity.
2. Plug the unit into the AC power, and power ON.
3. Choose **Main Menu** > **Systems Setting** > **Device info** > **Service Info** > **Service Tests>PPPTEST2.EXE.**See "Service Tests" on page 25.

4. Turn fast charge ON. Check DVM for 6.8 to 7.3 VDC.
5. Turn fast charge off. Check DVM for 6.3 to 6.8 VDC.
6. Unplug the unit from the AC power.
7. Disconnect the DVM and install the battery.

## LED Test

Verify the Power LED light is on when unit is plugged in, and verify the light is off when unit is unplugged.

1. Plug the unit into AC power.
2. Verify the AC indicator LED under the On/Standby button is lit.
3. Unplug the AC power cord.
4. Verify the LED is off.
5. Plug the unit back into AC power.

**Note** There may be a few seconds delay in the LED response to the line being removed and added.

## LCD Test

### CP 200

1. Choose **Main Menu** > **Systems Setting** > **Device info** > **Service Info** > **LCD Test.**
2. Verify the test pattern is visible without breaks and is consistent over the entire screen.
3. Verify Contrast can be adjusted to adequately see the display.

### CP 100

1. Disconnect the patient cable.
2. Turn **ON** unit. The patient hook up screen appears.
3. Verify the display is visible without breaks.

**Note** If contrast adjustment is needed refer to the Directions for Use manual for CP 100.

## Set Unit Initial Configuration/SD Slot Test

### Initial Configuration of Unit

1. Verify the Serial Number on the unit is the same as displayed on the unit's screen. If incorrect, enter correct S/N. See "“System Settings” Menu Tree" on page 16, Service Info.

Select **Main Menu** > **System Settings** > **Device Info** > **Service Info** > **Serial Number**.

2. If the main board was replaced and a configuration files were exported, import the configuration files, see "Import Files" on page 24.
3. Print the Configuration of the unit.

   Select **Main Menu** > **System Settings** > **Device Info** > **Print Settings**
4. Verify the settings from the printout.
   a. Check for software version installed.
   b. S/N of the unit.
   c. Interpretation (if applicable).

If imported, check any customized customer settings.

### SD Slot Test

1. Insert a formatted SD memory card into the unit.
2. Choose **Main Menu** > **System Settings** > **Device info** > **Service Info** > **Service Tests>MMCSDTEST.EXE** file.
3. Press **G** to start the test. After 30 seconds the MyFile.TXT increases one increment.
4. Press **S** to stop the test and confirm that no errors are reported.

## ECG Communication Test (ECG Input test and lead off)

Test the patient cable and lead off indications connection.

1. Connect a known good Patient Cable w/leads
2. Connect to ECG simulator with V1/C1 lead disconnected.
3. Power **ON** unit.
4. Verify the lead placement screen shows V1/C1 lead flashing and **all** other leads should appear not flashing.
5. Remove LL from the Simulator and verify LL flashes with **all** V/C leads grayed, RA,LA & RL should not be flashing.
6. Connect all leads to the simulator.
7. Verify all leads stop flashing and the next screen appears in approximately three seconds.

## Spirometer Communication Test

### CP 200 (Only)

Verify and test the connection of a Spirometer Dongle to the serial port.

1. Attach a known good spirometer dongle to the spirometer port on the side of the unit.
2. Power **ON** unit.

3. Press the Spirometry button
4. Verify that the unit opens the Spirometry module without errors.

## USB Communications Test

Verify the test connection between the unit and the CardioPerfect Workstation computer.

1. Connect the unit to the computer using a USB A-A Cable.
2. The computer should recognize the CP 200 connected and load the driver for communication.
3. Transfer an ECG record to the CardioPerfect Workstation.
   a. Press the **Menu** button.
   b. Choose **Test Directory**.
   c. Press the **Search** softkey.
   d. Press the **WorkStation** softkey.
4. Verify the record was transferred into the workstation.

## Beeper Test

Turn on and test the Audible beeper by using the keyboard keys.

1. Power **On** unit.
2. Choose **Main Menu** > **System Settings** > **Device Configuration** > **Audio Beeper >** set to **ON.**
3. Exit the **Main Menu**
4. Verify that an Audible beep is heard when invalid keys are pressed on the keyboard.
5. If the Audio Beeper was originally set to off, choose **Main Menu** > **System Settings** > **Device Configuration** > **Audio Beeper >** set to **OFF** to return the Audio Beeper to its original setting.

# Keyboard Test

The unit detects all the keys pressed listed in Table 1, "Keyboard Keys".

**Table 1. Keyboard Keys**

| Key | CP 100 | CP 200 |
|---|---|---|
| '5' | 5 | 5 |
| 'R' | R | R |
| 'D' | D | D |
| 'X' | X | X |
| Backspace | Back a space | Back a space |
| 'P' | P | P |
| Down | Down a field | Down a field |
| Up | Up a field | Up a field |

1. Power **On** unit.
2. Press **Auto ECG**. See Figure 9 on page 14 for button location.
3. The patient information screen appears.
4. Press the Keys indicated in Table 1, "Keyboard Keys" and verify the corresponding action.
5. Use the softkeys to verify the correct response for the keys (Only for the CP 200 unit). See Figure 10 on page 15.

# Printer Test

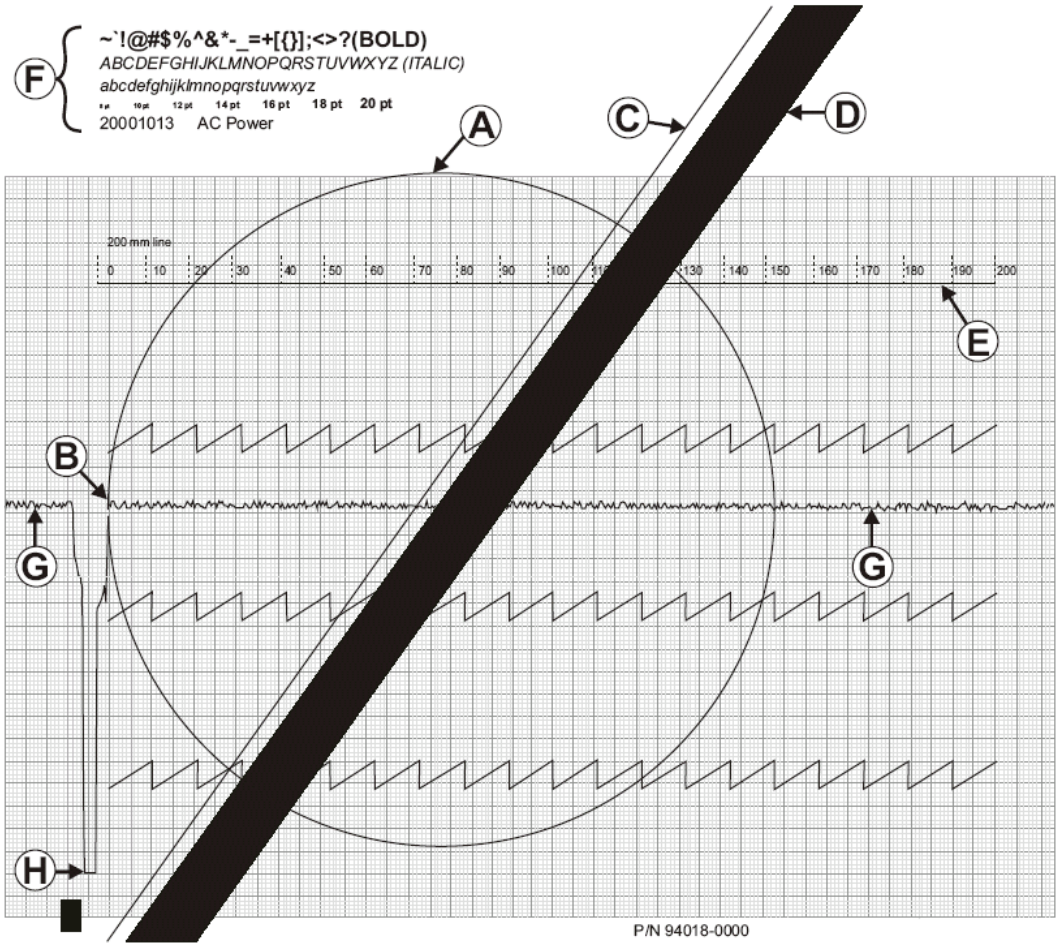
**Note** Please note these measurements are dependent upon the tracking of the paper being in the center. Please make sure there is no curling/crinkling of the paper at the top or bottom when printing.

1. Plug unit into AC power to perform the printer test.
2. Choose **Main Menu** > **System Settings** > **Device Info** > **Service Info** > **Printer Test.**
3. Press the "Test Page" softkey. The test print starts after a few seconds.
4. Press the "Cancel" softkey when the second page has completed printing.
5. Use the second test print page to verify correct operation. See Table 2, "Print Verification Check List" and Figure 29 on page 36.

**Table 2. Print Verification Check List**

| Point | Description |
|---|---|
| Point A | Verify the distance of the arc on the circle from the top edge of the paper is 37mm +/- 3mm |
| Point B | Verify the distance of the arc on the circle from the left edge of the paper is 45mm +/- 5mm |
| Point C | Verify line is straight and without breaks from top to bottom |
| Point D | Verify thick black line is Uniform in Blackness without breaks from top to bottom |
| Point E | Verify line is straight and measures 200mm +/- 4mm |
| Point F | Verify the print is readable |
| Point G | Verify the lead in and output trail of the cue sensor are between 19 and 82mm down from the 200mm line measured in point E |
| Point H | Verify the cue sense pattern is between 97 and 135mm down from the 200mm line measured in point E |

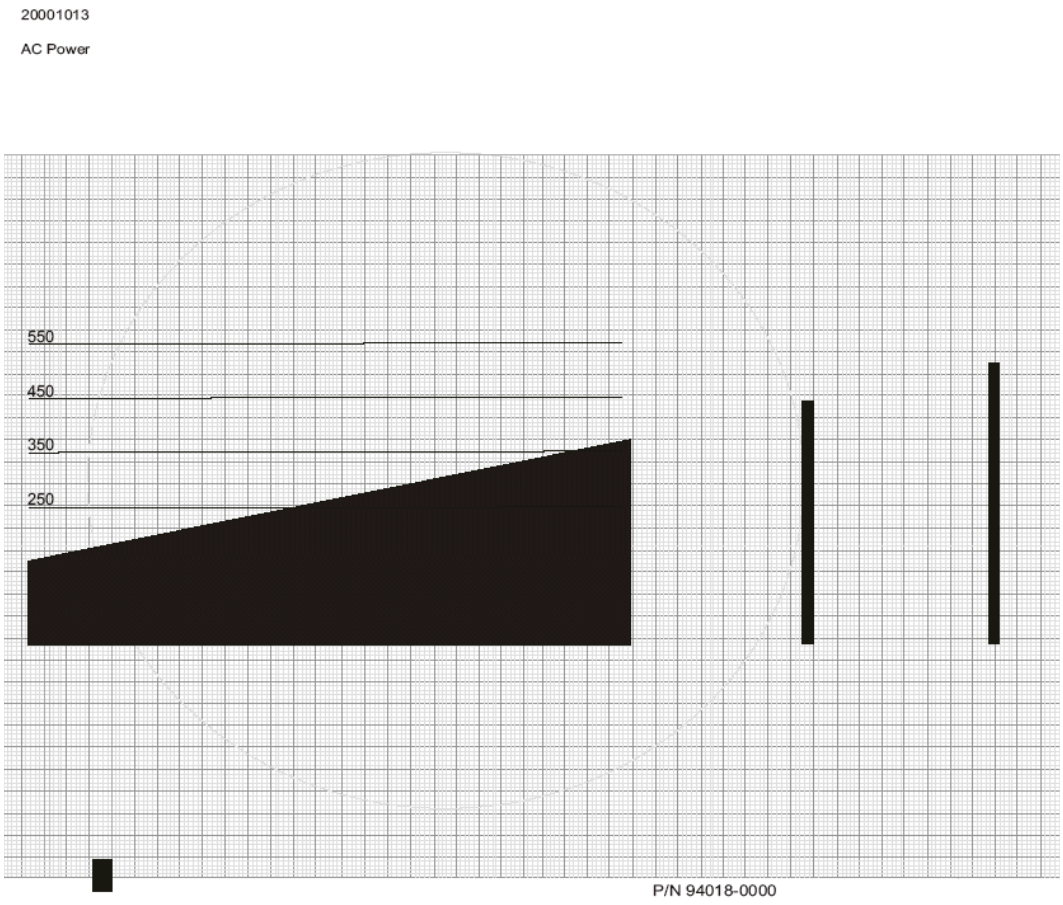
**Figure 29. Test Printout Example**



## Ramp Page Test Printout

1. Press the Ramp Page key.
2. Verify the top of the ramp cuts off between 250 and 550 on the gauge printed.

**Figure 30. Ramp Printout Example**



# Dielectric Strength Test

It is important to complete the dielectric strength test after any procedure in which the monitor is opened to verify proper patient isolation.

**WARNING** Failure to run the dielectric test when indicated could cause serious injury to patients, and could lead to damage to the monitor.

**WARNING** Always follow the tester manufacturer's operation instructions exactly. Failure to perform this test properly can result in serious injury or death.

**WARNING** This test must be performed by qualified service personnel only.

**WARNING** Run this test, only, on an insulated table top, and away from other people and equipment.

**WARNING** Must avoid connector shell and pe ground because pe is only resistant to 500 Vac.

**WARNING** The patient isolation test involves exposure to extremely high voltages and is extremely hazardous.

The patient isolation test requires an AC Withstand Voltage (hi-pot) Tester, such as the AR 3605 or equivalent. If this equipment is not available, Welch Allyn can perform the patient isolation test for you quickly, for a nominal fee.

To create test cables for the patient isolation test. See "Hi-Pot Test Connections" on page 39.

Set up the test parameters on the AC Withstand Voltage Tester as follows:

**Note** Refer to the tester manufacturer's operation manual for complete details on set up and use.

| Parameter | Specification |
|---|---|
| Voltage | 1500Vac |
| Maximum Limit | 5.00mA |
| Minimum Limit | 0.15 mA |
| Ramp Up | 10 s |
| Dwell | 1 min. |
| Delay | 0.5 s |
| Ramp Down | 0.0 s |
| Arc Sense | 0 |
| Frequency | Local line (50 Hz or 60 Hz) |
| Continuity | Off |
| Connect | Off |

To create test cables for this procedure. See "Hi-Pot Test Connections" on page 39.

1. Connect the modified power cord between the return jack on the tester and the AC input of the unit.
2. Connect the high voltage cable between the equipotential stud and the high voltage on the tester.
3. Press the test button to run the AC withstand voltage test.

4. Verify the electrocardiograph passed the test. (If the unit current never exceeds 5.00mA, the shielding is sufficient.)

## Hi-Pot Test Connections

| Cable | Electrocardiograph Connection | | Hi-Pot Tester Connection | |
|---|---|---|---|---|
| | Connector/ Cable | Connect to | Wiring | Connect to |
| Power Cord | IEC Power cord | AC Input Connector | Hot and neutral (black and white) wires connected together and terminated appropriately for your hi-pot tester. Cut and terminate the ground (green) wire to prevent possible injury. | Return |

## Chassis, Earth and Patient Leakage Current Tests

Verify continued electrical safety of the device, using IEC 60601-1 or ANSI/AAMI ES1 methods and limits. Test for the following:

- Earth leakage
- Chassis leakage
- Patient leakage

**Note** Refer to the Electrical Safety Analyzer manual for complete details on set-up and use for testing.

# Checklist and Test Results Report Form

Use a copy of the form to track your progress though the validation tests.

| |
|---|
| Electrocardiograph Serial #: |
| Tested by: |
| Test date: |

| Initial | Test | Result | Pass (or N/A) | Fail |
|---|---|---|---|---|
| | Operating Non-Printing Mode Current | CP 100: _____ (mA)<br>CP 200: _____ (mA) | | |
| | Battery Accuracy | Normal: | | |
| | | Critical: | | |
| | Sleep/Standby Current | (mA) | | |
| | Charger Detect | Fast Charge: (VDC) | | |
| | | Trickle: (VDC) | | |
| | LED | | | |
| | LCD | | | |
| | Initial Configuration/ SD Card | | | |
| | ECG Communication | | | |
| | Spirometry | | | |
| | USB Communication | | | |
| | Beeper | | | |
| | Keyboard | | | |
| | Printer | Test Page: | | |
| | | Ramp Page: | | |

# 4 Troubleshooting

Problem-Solving Suggestions . . . . . 42
Limited Warranty . . . . . 45
Service Policy. . . . . 46

# Problem-Solving Suggestions

**Caution** Replace parts, components, or accessories only with parts supplied or approved by Welch Allyn. The use of any other parts can lead to inferior device performance and will void the product warranty.

This section includes several tables:

- Lead quality problems (Table 3)
- System failure problems (Table 4, on page 43)
- System messages (Table 5, on page 44)

If you try these suggestions and still have problems, contact Technical Support. For phone numbers, see "For information about any Welch Allyn product, please call Welch Allyn Technical Support:" on page ii

**Table 3. Lead Quality Problems**

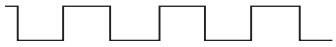
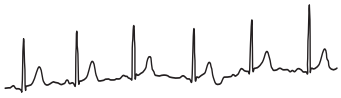
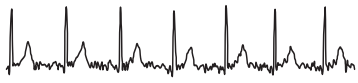
| Condition | Causes | Actions |
|---|---|---|
| A red dot is flashing on the **Lead Off** screen. (CP 200)<br><br>A dot is flashing on the **Lead Off** screen. (CP 100)<br><br>OR<br><br>Lead-off information is displayed on the screen.<br><br>OR<br><br>One or more leads prints as a square wave:<br>  | • Electrode contact may be poor.<br>• A lead may be loose. | • Reattach the lead.<br>• Replace the electrode.<br>• Verify that the electrode area has been properly prepared: shaved, cleaned with alcohol or acetone, allowed to dry.<br>• Verify that electrodes have been properly stored and handled. |
| Wandering baseline (an upward and downward fluctuation of the waveforms):<br>  | • Electrodes that are dirty, corroded, loose, or positioned on a bony area.<br>• Insufficient or dried electrode gel.<br>• Oily skin or body lotions.<br>• Rising and falling of chest during rapid or apprehensive breathing. | • Clean skin with alcohol or acetone.<br>• Reposition or replace electrodes.<br>• Help patient relax.<br>• If wandering baseline persists, turn the baseline filter on. See "Base Line Filter" in the CP 200 Directions for Use Manual.<br>See "Adjust Baseline Filter" in the CP 100 Directions for Use Manual. |
| Muscle tremor interference (random, irregular voltage superimposed on the waveforms). May resemble or coincide with AC interference:<br>  | • Patient is uncomfortable, tense, nervous.<br>• Patient is cold and shivering.<br>• Exam bed is too narrow or short to comfortably support arms and legs.<br>• Arm or leg electrode straps are too tight. | • Help patient get comfortable.<br>• Check all electrode contacts.<br>• If interference persists, turn the muscle-tremor filter on. See "Muscle Filter" in the CP 200 Directions for Use Manual.<br>See "Adjust Muscle Filter" in the CP 100 Directions for Use Manual.<br>• If interference still persists, the problem is probably electrical in nature. See the following suggestions for reducing AC interference. |

**Table 3. Lead Quality Problems (continued)**

| Condition | Causes | Actions |
|---|---|---|
| AC interference (even-peaked, regular voltage superimposed on the waveforms). May resemble or coincide with muscle-tremor interference. | • Electrodes that are dirty, corroded, loose, or positioned on a bony area.<br>• Insufficient or dried electrode gel.<br>• Patient or technician touching an electrode during recording.<br>• Patient touching any metal parts of an exam table or bed.<br>• Broken lead wire, patient cable, or power cord.<br>• Electrical devices in the immediate area, lighting, concealed wiring in walls or floors.<br>• Improperly grounded electrical outlet.<br>• Incorrect AC filter frequency setting or AC filter is turned off. | • Check all electrode contacts and lead wires.<br>• Verify that the patient is not touching any metal.<br>• Verify that the AC power cable is not touching the patient lead cable.<br>• Verify that the proper AC filter is selected. See "Mains Filter" in the Directions For Use manual.<br>• If interference persists, unplug the electrocardiograph from AC power and run it on the battery. If this solves the problem, you'll know that the noise was introduced through the power line.<br>• If interference still persists, the noise may be caused by other equipment in the room or by poorly grounded power lines. Try moving to another room. |

**Table 4. System Failure Problems**

| Condition | Causes | Actions |
|---|---|---|
| Won't turn on when plugged into AC power. | • Faulty AC power connection.<br>• Blown AC fuses.<br>• No AC power. | • Check the AC power source.<br>• Check the AC fuses. See "Replacing the AC Fuses" in the Directions for Use manual. |
| Won't turn on when unplugged from AC power. | • Battery disconnected or incorrectly connected.<br>• Battery low, not charging, depleted, or bad.<br>• Blown battery fuse. | • Check battery connections. See"Replacing the Battery or Fuse" on page 58.<br>• Recharge the battery. See "Recharging a Fully Discharged Battery" in the Directions for Use manual.<br>• Replace battery. See"Replacing the Battery or Fuse" on page 58.<br>• Replace battery fuse. See "Replacing the Battery (DC) Fuse" on page 60. |
| Shuts down during printing | Battery low or bad. | • Recharge the battery. See "Recharging a Fully Discharged Battery" in the Directions for Use manual.<br>• Replace battery. See"Replacing the Battery or Fuse" on page 58. |
| Prints fewer than 10 reports on a full battery charge. | Degraded battery. | Replace battery. See"Replacing the Battery or Fuse" on page 58. |

**Table 5. System Messages (alphabetical order)**

| System Message | Problems | Actions |
|---|---|---|
| "A test is being printed that has not been saved and will be lost. Continue shutdown?" (CP 200) | was pressed while printing an Auto ECG. | To shut down without saving the test, press . To cancel the shutdown, press . |
| "Audit Trail is too large. Please print and purge." (CP 200) | Audit information is approaching its maximum allotted storage. | Print and purge the audit trail. See "Working With the Audit Trail". |
| "Battery extremely low. Please connect AC power." | Battery low or bad. | • Recharge the battery. See "Recharging a Fully Discharged Battery" in the Directions for Use manual.<br>• Replace battery. See"Replacing the Battery or Fuse" on page 58. |
| "Insufficient space available" | Not enough space on memory card. | • Delete some tests from the card at a PC.<br>• Use a different card. |
| "Memory card error" | Problem writing to memory card. | • Verify that the write-protect tab is in the unprotected position.<br>• Reseat the card in its slot.<br>• Use a different card. |
| "Out Of Paper" | • Printer is out of paper.<br>• Printer door is open. | • Load paper. See "Loading the Thermal Chart Paper" in the Directions for Use.<br>• Close the printer door. See "Loading the Thermal Chart Paper" in the Directions for Use. |
| "Paper Error" (CP 200)<br>"Paper Jam" ( CP 100) | Paper was loaded incorrectly. | • Reload the paper. See "Loading the Thermal Chart Paper" in the Directions for Use. |
| "Powering down" | Low battery. | Recharge the battery. See "Recharging a Fully Discharged Battery". |
| "Problem loading the following settings:<br><System><br><ECG><br>*<br>*<br>*<br>Using default settings." | Problem loading your settings at startup. May indicate memory problems. | Contact Technical Support. For phone numbers, seepage ii. |
| "Shutdown?" | was pressed while printing a Rhythm ECG. | To shut down, press . To cancel the shutdown, press . |
| "Temperature Error" | Printer head temp is too high. | Allow to cool, then try again. |
| "Test has not been saved. Continue shutdown?" (CP 200) | was pressed after printing an Auto ECG. | To shut down without saving the test, press . To cancel the shutdown, press . |
| "Unable to communicate with workstation" (CP 200) | • Configuration not correct.<br>• Cable not properly connected. | • Verify communication settings on the PC.<br>• Check cable connections. |

# Limited Warranty

Welch Allyn, Inc., warrants that the Cardiopulmonary line of electrocardiographs, including the CP 100 and CP 200 models (the Products) meet the labeled specifications of the Products and will be free from defects in materials and workmanship that occur within 3 years after the date of purchase, except that accessories used with the Products are warranted for 90 days after the date of purchase. Such accessories include: lead wires, cabling, electrodes, and battery.

The date of purchase is: 1) the date specified in our records, if you purchased the Product directly from us, 2) the date specified in the warranty registration card that we ask you to send to us, or 3) if you don't return the warranty registration card, 30 days after the date on which the Product was sold to the dealer from whom you bought the Product, as documented in our records.

This warranty does not cover damage caused by: 1) handling during shipping, 2) use or maintenance contrary to labeled instructions, 3) alteration or repair by anyone not authorized by Welch Allyn, and 4) accidents.

If a Product or accessory covered by this warranty is determined to be defective because of defective materials, components, or workmanship, and the warranty claim is made within the warranty period described above, Welch Allyn will, at its discretion, repair or replace the defective Product or accessory free of charge. If your Product requires repairs covered by this warranty, upon your request Welch Allyn will loan to you, at no cost, a substitute Product for use until your repaired Product is returned.

You must obtain a return authorization from Welch Allyn to return your Product before you send it to Welch Allyn's designated service center for repair. Contact Welch Allyn Technical Support. For phone numbers, see page ii.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILTY AND FITNESS FOR A PARTICULAR PURPOSE. WELCH ALLYN'S OBLIGATION UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF PRODUCTS CONTAINING A DEFECT. WELCH ALLYN IS NOT RESPONSIBLE FOR ANY INDIRECT OR CONSEQUENTIAL DAMAGES RESULTING FROM A PRODUCT DEFECT COVERED BY THE WARRANTY.

# Service Policy

All repairs on products under warranty must be performed or approved by Welch Allyn. Unauthorized repairs will void the warranty. In addition, whether or not covered under warranty, any product repair shall exclusively be performed by Welch Allyn certified service personnel.

If the product fails to function properly—or if you need assistance, service, or spare parts—contact the nearest Welch Allyn Technical Support Center. For phone numbers, see page ii.

Before contacting Welch Allyn, try to duplicate the problem, and check all accessories to ensure that they are not causing the problem. When calling, please be prepared to provide:

- Product name and model number and complete description of the problem.
- Serial number of your product (if applicable).
- Complete name, address and phone number of your facility.
- For out-of-warranty repairs or spare parts orders, a purchase order (or credit card) number.
- For parts orders, the required spare or replacement part numbers.

If your product requires warranty, extended warranty, or non-warranty repair service, please call first the nearest Welch Allyn Technical Support Center. A representative will assist you troubleshooting the problem and will make every effort to solve it over the phone, avoiding potential unnecessary returns.

In case a return cannot be avoided, the representative will record all necessary information and will provide a Return Material Authorization (RMA) number, as well as the appropriate return address. An RMA number must be obtained prior to any return.

If you have to return goods for service, follow these recommended packing instructions:

- Remove all hoses, cables, sensors, power cords, and ancillary products (as appropriate) before packing, unless you suspect they are associated with the problem.
- Wherever possible use the original shipping carton and packing materials.
- Include a packing list and the Welch Allyn Return Material Authorization (RMA) number.

It is recommended that all returned goods be insured. Claims for loss or damage to the product must be initiated by the sender.

# 5 Disassembly and Repair Procedures

Introduction . . . . . 48
Screws . . . . . 48
Torque Specs . . . . . 48
Disassembly Procedures . . . . . 49

# Introduction

These procedures cover CP 200 and CP 100 electrocardiograph disassembly for sub-assemblies and board removal. Unless otherwise noted:

- The procedure is the same for both units.
- The assembly procedure is the reverse of the disassembly procedure.

**Caution** Perform all repair procedures at a static-protected station. Observe recommended screw torque specifications, especially with screws that secure directly into plastic standoffs.

**WARNING** The battery can deliver currents sufficient to cause serious personal injury and to damage the electrocardiograph. When opening the electrocardiograph for any reason, always remove and disconnect the battery immediately, before proceeding with disassembly.

# Screws

**Caution** To avoid mismatching screws and holes, keep the screws for each piece with the piece as you remove modules, circuit assemblies, and other components.

# Torque Specs

The Following are recommended torque specs for all screws and hex nuts..

**Table 6. Torque Specifications s**

| Qty | Location | Part Number | Type | Torque (English) | Torque (Metric) |
|---|---|---|---|---|---|
| 1 | Paper Drive Gear | 700091 | Set Screw | 3.5 +/- .25 lbf-in | 395 + /- 28 mN-m |
| 4 | Paper Cover Latch | 711776 | Machine | 3.5 +/- .25 lbf-in | 395 + /- 28 mN-m |
| 2 | Drive Motor | 700140 | Machine | 3.5 +/- .25 lbf-in | 395 + /- 28 mN-m |
| 1 | Drive Motor Gear | 700091 | Set Screw | 3.5 +/- .25 lbf-in | 395 + /- 28 mN-m |
| 3 | Gear Box Assembly | 711776 | Machine | 3.5 +/- .25 lbf-in | 395 + /- 28 mN-m |
| 2 | Paper Sensor Board | 711776 | Machine | 3.5 +/- .25 i lbf-in | 395 + /- 28 mN-m |
| 2 | Print head mount | 700118 | Shoulder Screw | 4 +/- .25 lbf-in | 452 +/- 28 mN-m |
| 1 | Ground to Shoulder Screw | 106137-1 | Hex nut | 3.5 +/- .25 lbf-in | 395 + /- 28 mN-m |
| 3 | Paper Guide | 711776 | Machine | 3.5 +/- .25 lbf-in | 395 + /- 28 mN-m |
| 2 | Ground Plug | 102-0001 | Hex Nut | 16 +/- .25 lbf-in | 1.81+/- .028 N-m |
| 4 | Power Supply | 106124-4 | Machine | 3.5 +/- .25 lbf-in | 395 + /- 28 mN-m |
| 5 | Main PCB | 106124-4 | Machine | 3.5 +/- .25 lbf-in | 395 + /- 28 mN-m |
| 4 | LCD Assembly / Bracket | 106140-3 | Machine | 3.5 +/- .25 lbf-in | 395 + /- 28 mN-m |
| 2 | Inverter Board | 200076-1 | Thread-Forming | 1 +/- .25 lbf-in | 113 +/- 28 mN-m |
| 5 | Function Key Board | 106124-4 | Machine | 3.5 +/- .25 lbf-in | 395 + /- 28 mN-m |
| 13 | QWERTY Keyboard | 106124-13 | Thread-Forming | 1 +/- .25 lbf-in | 113 +/- 28 mN-m |
| 4 | Printer Assembly | 703247 | Machine | 3.5 +/- .25 lbf-in | 395 + /- 28 mN-m |
| 8 | Housing | 703247 | Machine | 3.5 +/- .25 lbf-in | 395 + /- 28 mN-m |
| 2 | Battery Cover | 703247 | Machine | 3.5 +/- .25 lbf-in | 395 + /- 28 mN-m |

# Disassembly Procedures

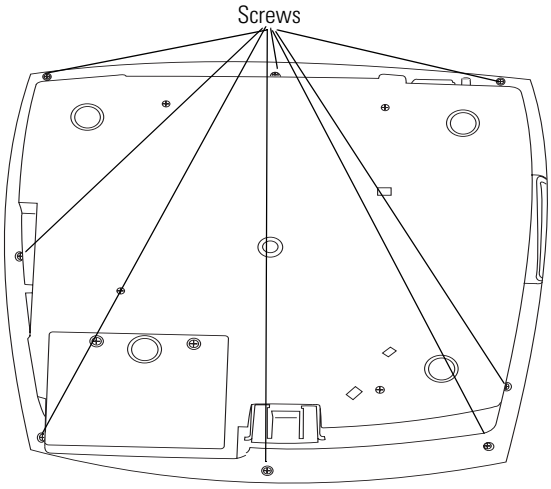
## Opening the Unit

**WARNING** Disconnect ALL power from the unit before repairing or disassembling unit. Unplug the power cord and disconnect the battery at the fuse in the battery compartment. See Replacing the Battery or Fuse (page 58)

**Procedure**

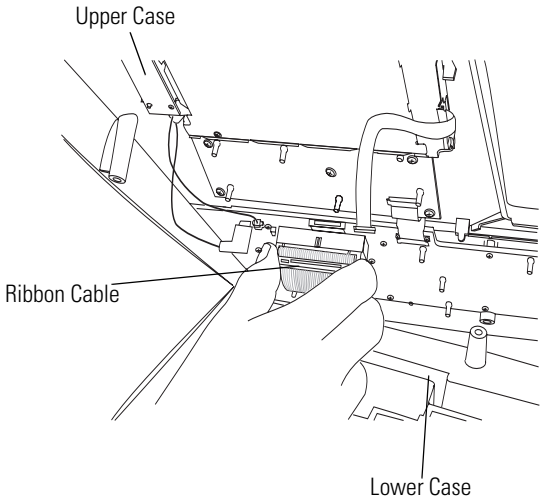
1. Place unit on a clean, static mat.
2. Turn the unit up-side-down
3. Remove the 8 screws around the outside rim of the unit. SeeFigure 31.

**Figure 31. Removing the Screws**




4. Using both hands, hold the upper case and lower case of the unit together, turn the unit upright.
5. Slowly lift the upper case, and disconnect the ribbon cable from the upper case.
6. Lift off the top cover. See Figure 32.

**Figure 32. Disconnecting the Ribbon Cable**

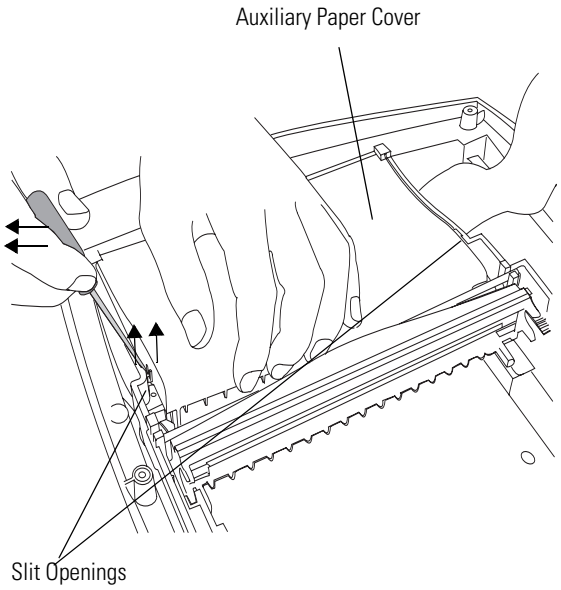


# Replacing the Printer Assembly

**Procedure**

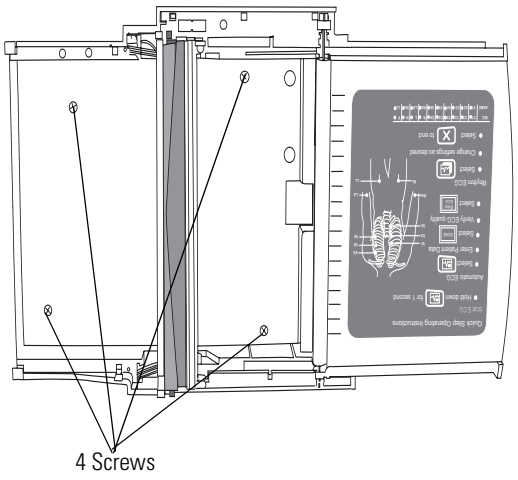
1. Open unit using the Disassembly Procedures (page 49) directions.
2. Open the paper door and remove **all** paper in the paper tray.
3. Insert a flat blade screwdriver into the slit opening located on the side of the auxiliary paper cover. Figure 33.
4. Apply outward pressure on the screwdriver while pressing upward on the side of the cover. Repeat process for the other side of the cover. Lift the cover out of unit.

**Figure 33. Inserting a Flat blade Screwdriver**




5. Remove the 4 screws in the bottom of the printer tray. See Figure 34.

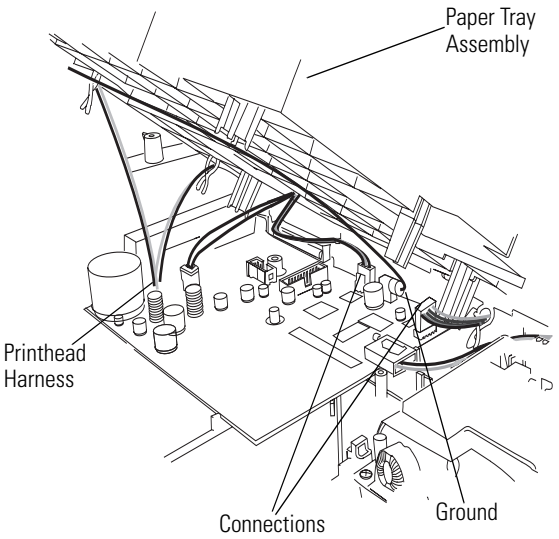
**Figure 34. Removing the Screws in the Paper Tray**



**Procedure**

6. Slide the paper tray cover until it locks into place before lifting the paper tray assembly.
7. Slowly lift the paper tray assembly and remove the connections. See Figure 35

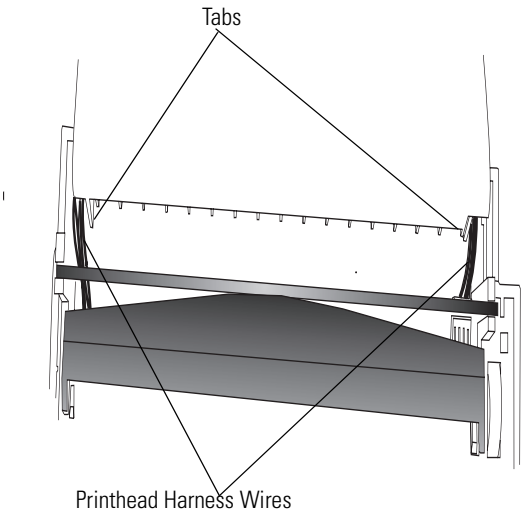
**Figure 35. Lifting the Paper Tray Assembly**




## Reassembly Note

1. Keep the black printhead harness wires behind the tabs on the auxiliary tray cover as you place the cover into the assembly.
2. When pressing the auxiliary paper cover into place, listen for two distinct clicks when the tabs lock into place.

**Figure 36.**

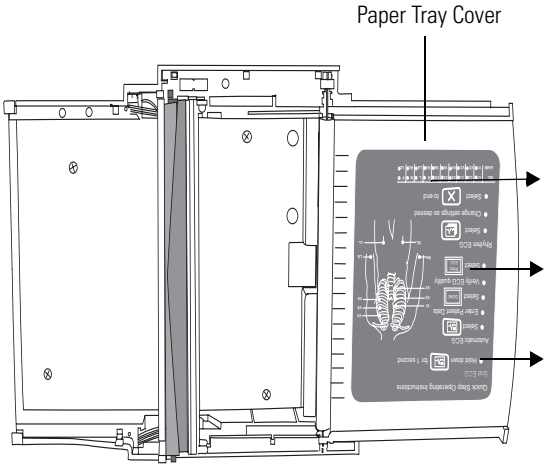


# Replacing the Paper Tray Cover

**Procedure**

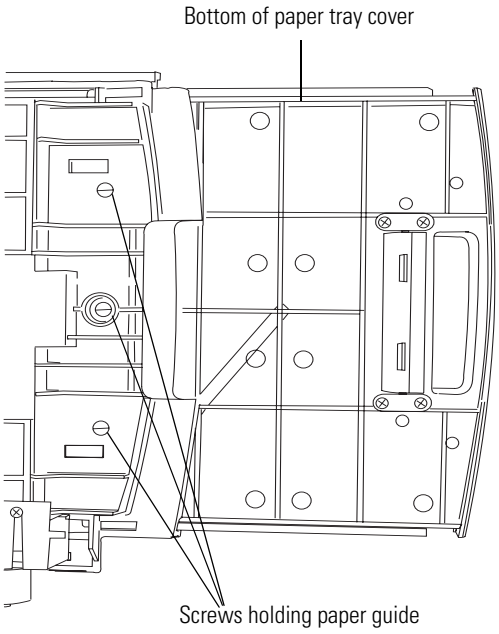
1. Open the unit using the Disassembly Procedures (page 49) directions.
2. Next, remove the paper tray cover. See Replacing the Printer Assembly (page 50).
3. Slide the paper tray cover out until it stops. See Figure 37.

**Figure 37. Sliding the Paper Tray Cover**




4. Turn paper tray assembly up-side-down.
5. Remove the 3 screws holding the paper guide. See Figure 38.

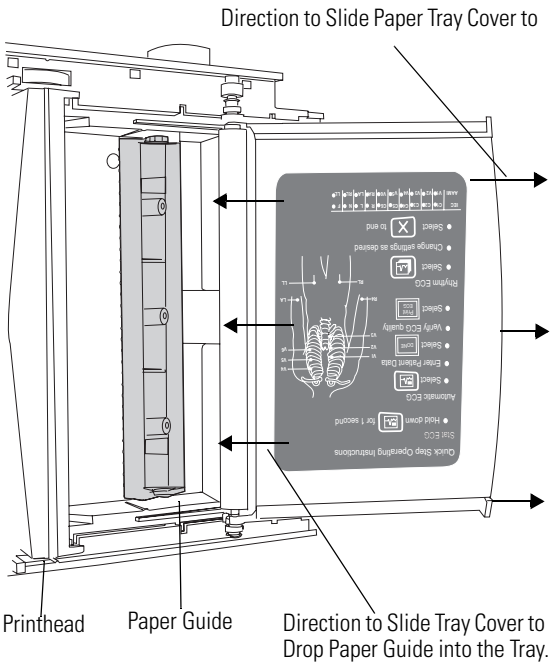
**Figure 38. Bottom of the Paper Tray Assembly**



**Procedure**

6. Turn the paper tray assembly upright.
7. Slide the paper tray cover in half way until the paper guide drops into the paper tray.
8. Slide the paper tray cover out to remove it. Figure 39.

**Figure 39. Removing the Paper Tray Cover**


Direction to Slide Paper Tray Cover to
Printhead
Paper Guide
Direction to Slide Tray Cover to Drop Paper Guide into the Tray.

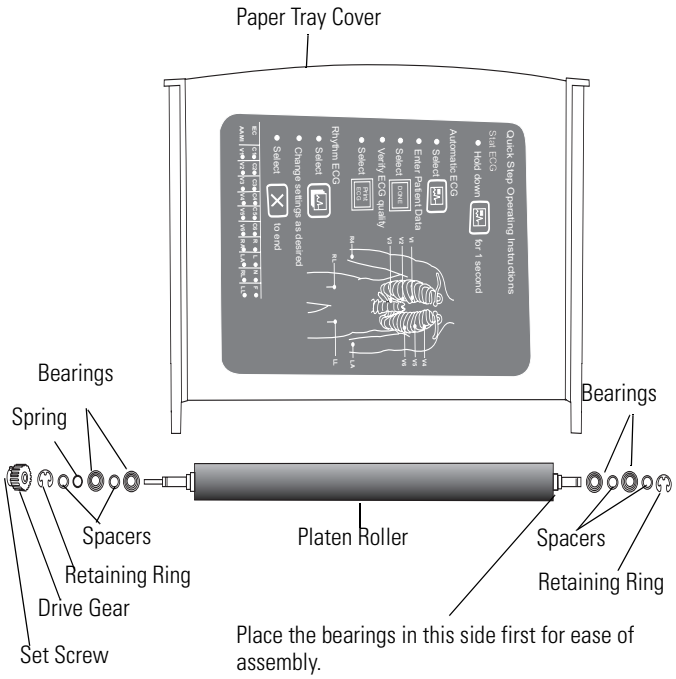
## Reassembly Note

1. Slide the paper tray cover half way into the paper tray assembly.
2. Place the paper guide under the roller on the paper tray cover.
3. While holding the paper guide in place, slide the paper tray cover out until it hits the stop.
4. Turn the paper assembly up-side-down.
5. Replace the 3 screws in the holes located in the bottom of the paper tray assembly. See Figure 38.

# Replacing the Platen Roller

**Procedure**

**Figure 40. Platen Roller**




1. Open unit using the Disassembly Procedures (page 49) directions.
2. Remove printer assembly using the Replacing the Printer Assembly (page 50) directions.
3. Remove the paper tray cover using the Replacing the Paper Tray Cover (page 52) directions.

**To remove the platen roller**

4. Loosen the set screw using a T5 Torx on the drive gear and slide the drive gear off the platen roller shaft.
5. Remove the retaining ring from both ends of the platen roller.
6. Lift the platen roller shaft out of the paper tray cover on the end opposite the drive gear.
7. Slide the roller out.

Reassemble Note

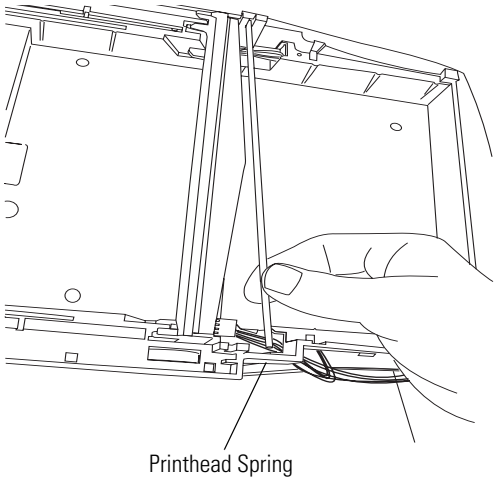
First, place the hardware into the side opposite the drive gear for ease of assembly.

# Replacing the Printhead

**Procedure**

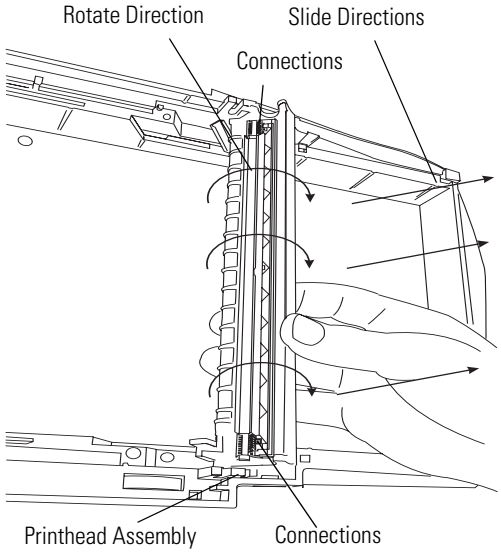
1. Open unit using the Disassembly Procedures (page 49) directions.
2. Remove printer assembly using the Replacing the Printer Assembly (page 50) directions.
3. Lift the printhead spring (metal rod behind printhead assembly) out of unit. See Figure 41.

**Figure 41. Lifting the Printhead Spring**




4. Slide and lift out the printhead assembly. See Figure 42.

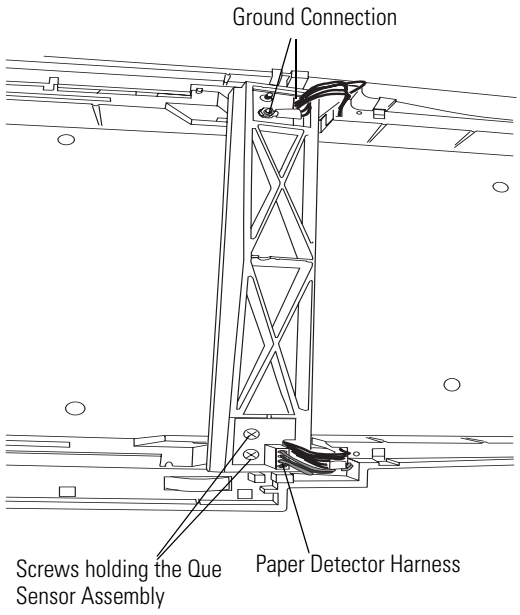
**Figure 42. Sliding and Lifting Out Printhead Assembly**



**Procedure**

5. Disconnect the paper detector harness from the back of the printhead assembly. See Figure 43
6. Disconnect the ground connection using a ¼" nut driver. See Figure 43
7. Remove the 2 shoulder screws from the opposite end of the printhead using a 3/16" nut driver.
8. Remove the 2 screws holding the Que sensor Assembly. See Figure 43.
9. Carefully remove the printhead connectors from both ends of the printhead. Figure 42 on page 55.

**Figure 43. Disconnecting Paper Detector Harness and Ground Connections**



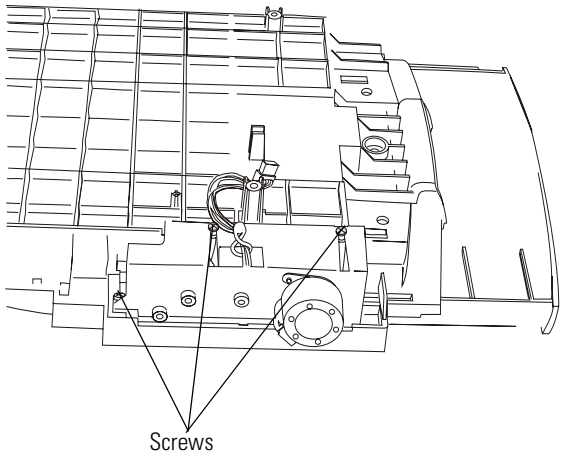

**Note** The printhead does not come with the Antistatic brushes. Order the Antistatic brushes separately. See *"Field Replaceable Parts"* on page 69

# Replacing the Stepper Motor and Gear Box

**Procedure**

1. Open unit using the Disassembly Procedures (page 49) directions.
2. Remove printer assembly using the Replacing the Printer Assembly (page 50) directions.
3. Open the paper tray cover about half way.
4. Turn paper tray assembly up-side-down.
5. Remove the 3 screws to remove the gear box and stepper motor. See Figure 44
6. Lift out the gear box and stepper motor.

**Figure 44. Bottom of the Printer Assembly**

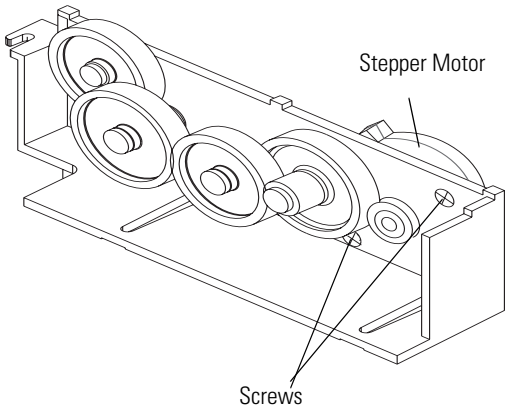



## Replacing the Stepper Motor

**Procedure**

1. Remove the 2 screw holding the motor. See Figure 45.
2. Remove the motor.

**Figure 45. Removing the Stepper Motor**

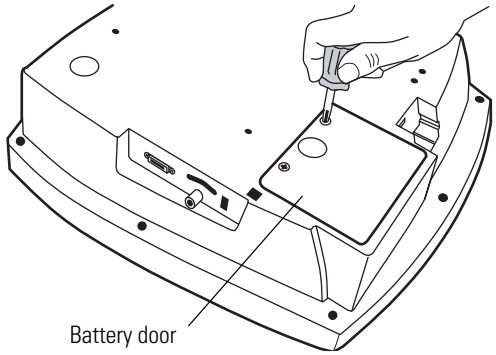


# Replacing the Battery or Fuse

**Procedure**

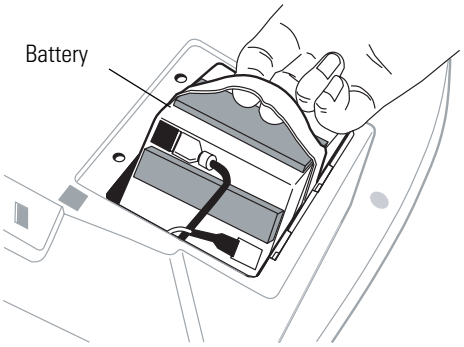
1. Turn the electrocardiograph up-side-down.
2. Unscrew and remove the battery door. See Figure 46.

**Figure 46. Removing the Battery Door**



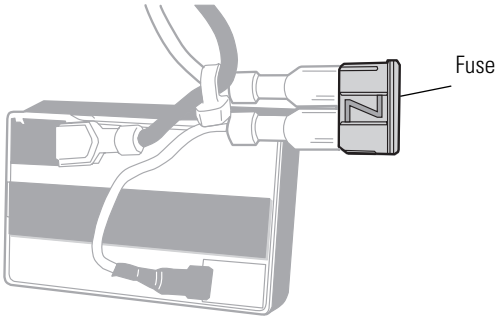

3. Lift out the battery. See Figure 47.

**Figure 47. Lifting Out the Battery**




4. Inspect the fuse. See Figure 48.
   - If the "Z" wire is intact, go to Step 5.
   - If the "Z" wire is broken or dark, replace the fuse. See "Replacing the Battery (DC) Fuse" on page 60.

**Figure 48. Battery Fuse Plugged In**



**Procedure**

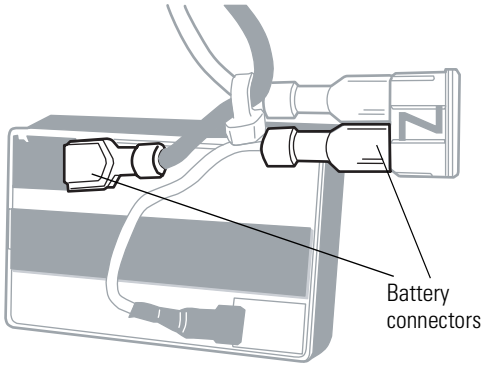
5. Unplug the two battery connectors. See Figure 49.
   - You may need to pull hard. Use pliers gently if necessary.
6. Connect a new battery by matching connector sizes.

   Do not force connectors to mismatch.
7. Place the battery into the battery compartment. Replace the battery door and screws. Turn the electrocardiograph right-side-up.

   It turns on automatically and displays a prompt to enter date and time.
8. Reset the unit after you replace the battery. See Battery Accuracy Test (page 31) for directions.
9. Enter the date and time.

   The electrocardiograph is ready to use.
10. Discard the old battery appropriately.

**Figure 49. Battery Connectors**




The battery is a sealed, lead-acid battery and must be recycled or disposed of properly according to national or local regulations.

# Replacing the Battery (DC) Fuse

If the battery (DC) fuse requires replacing, as described in "Replacing the Battery or Fuse" on page 58. For fuse value, see "Fuses" on page 77.

**Procedure**

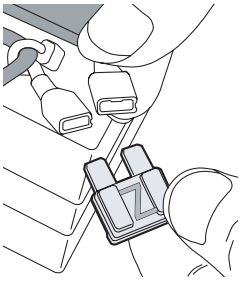
1. Remove and discard the fuse. See Figure 50.

   You may need to pull hard. Use pliers gently if necessary.

2. Connect a new fuse. It goes in either way.

3. Go to Step 7 on page 59.

**Figure 50. Battery Fuse Remove**

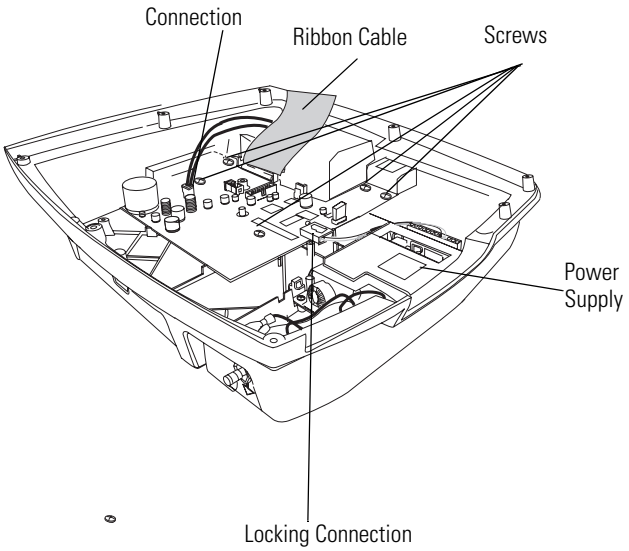


# Replacing the Main Board

**Procedure**

1. Open unit using the Disassembly Procedures (page 49) directions.
2. Remove printer assembly using the Replacing the Printer Assembly (page 50) directions.
3. Disconnect the locking connection for the power supply and the battery.
4. Remove the ribbon cable that attaches the top case.
5. Remove the 5 self taping screws holding the board into place. See Figure 51.
6. Carefully lift and slide the board toward the power supply.

**Figure 51. Removing the Main Board**

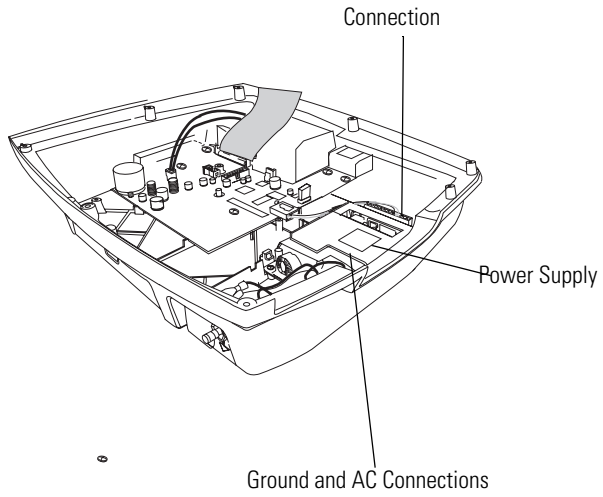


# Replacing the Power Supply

**Procedure**

1. Open unit using the Disassembly Procedures (page 49) directions.
2. Remove printer assembly using the Replacing the Printer Assembly (page 50) directions.
3. Disconnect connections from the power supply to main board. See Figure 52.
4. Disconnect Ground wire and AC input connections. See Figure 52.
5. Remove the 4 screws holding the power supply in place.
6. Lift out the power supply.

**Figure 52. Replacing the Power Supply**



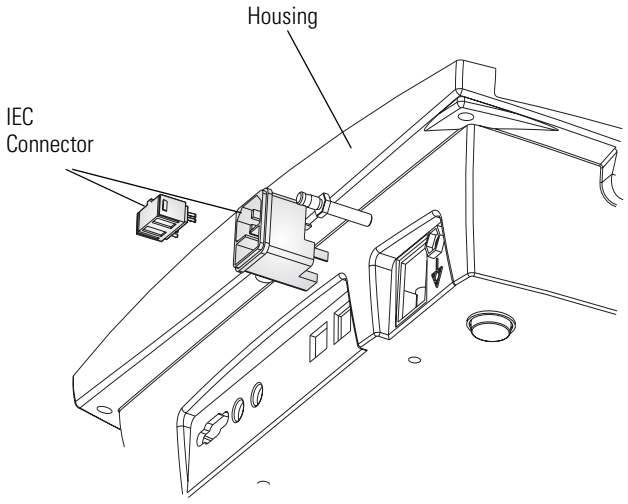
# Replacing the IEC (AC input) Connector

**Procedure**

1. Open unit using the Disassembly Procedures (page 49) directions.
2. Remove printer assembly using the Replacing the Printer Assembly (page 50) directions.
3. Disconnect connections from the back of the IEC connector.
4. Press in locking devices located on each side of the IEC connector.
5. While pressing in locking devices, apply pressure out on the connector.

   **Note** Do one side at a time.
6. After the locking devices are released, pull the connector out of the housing. See Figure 53.

**Figure 53. IEC (AC input) Connector**

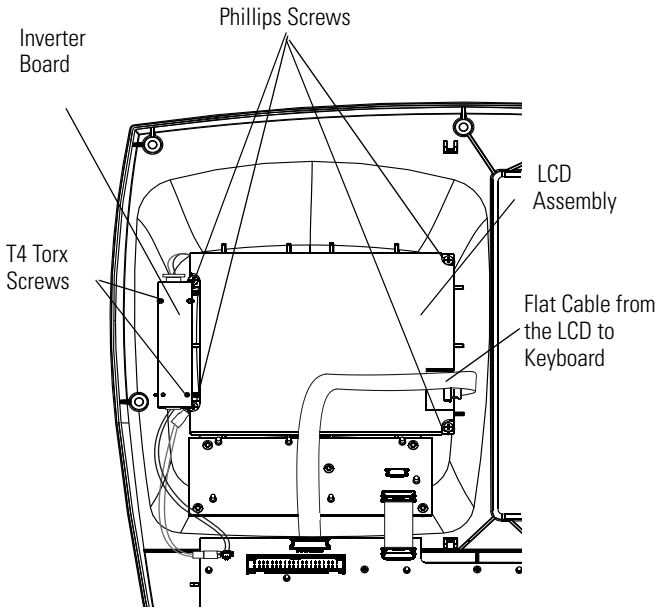


# Replacing the LCD Inverter and LCD Assembly (CP 200)

**Procedure**

1. Open unit using the Disassembly Procedures (page 49) directions.
2. Disconnect cable between the Inverter board and keyboard.
3. Remove the 2 T4 torx screws holding the LCD inverter in place. See Figure 54.
4. Disconnect the cable from the inverter to LCD backlight. See Figure 54.
5. Disconnect the flat cable from the LCD at the keyboard. See Figure 54.
6. Remove the 4 phillips screws in each corner of the LCD. See Figure 54
7. Remove the LCD.

**Figure 54. CP 200 Top Cover**

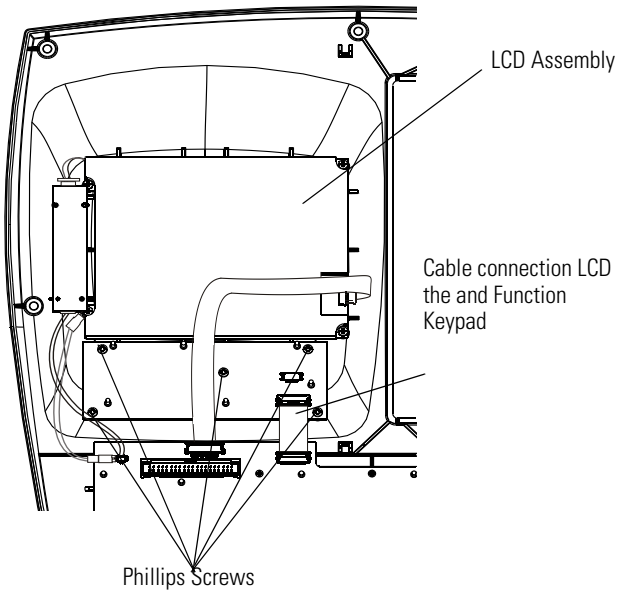


# Replacing the Function Keypad Assembly (CP 200)

**Procedure**

1. Open unit using the Disassembly Procedures (page 49) directions.
2. Disconnect the cables to the LCD and the Function Keyboard. See Figure 56.
3. Remove the 5 screws holding the Function Keypad Assembly. See Figure 58.
4. Gently lift out the Function Keypad Assembly.

**Figure 55. Replacing the Keypad Assembly**



# Replacing the Keyboard Assembly (CP 200)

**Procedure**

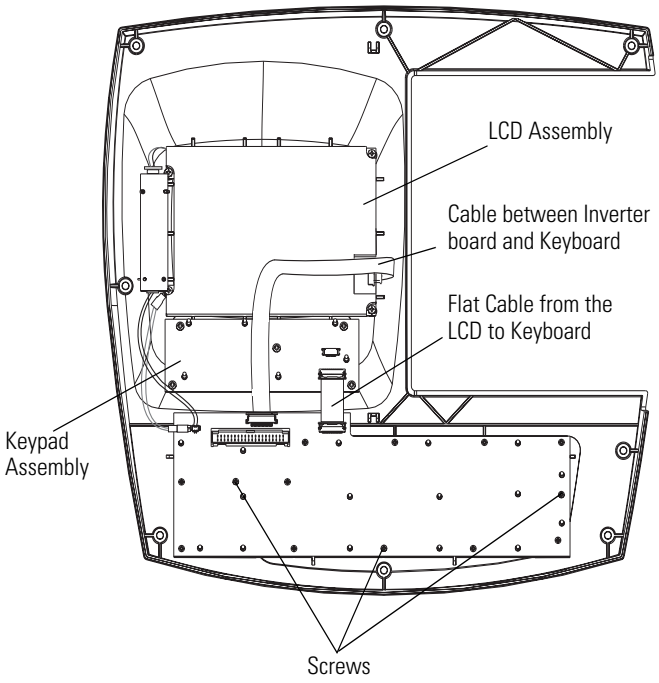
1. Open unit using the Disassembly Procedures (page 49) directions.
2. Disconnect the ground and the flat data cable to the LCD and the flat data cable, the cables to the Inverter, to the Keypad Assembly.
3. Remove the 13 screws holding in the Keyboard Assembly.
4. Gently lift out the Keyboard Assembly.

Reassembly Note

1. Install and tighten the 3 screws first (shown in Figure 56) to align the keyboard.

   DO NOT tighten the screws past the specified torque.
2. Install remaining 10 screws using the specified torque.

**Figure 56. Replacing the Keyboard Assembly (CP 200)**

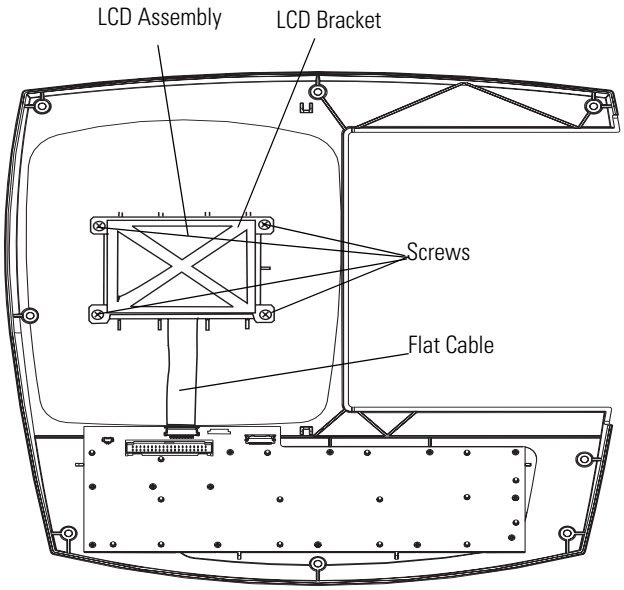


# Replacing the LCD Assembly (CP 100)

**Procedure**

1. Open unit using the Disassembly Procedures (page 49) directions.
2. Disconnect the flat cable from the keyboard. See Figure 57.
3. Remove the 4 screws securing the LCD bracket. See Figure 57.
4. Gently lift out the LCD bracket.
5. Gently lift out the LCD assemby.

**Figure 57. CP 100 Top Cover**



# Replacing the Keyboard Assembly (CP 100)

**Procedure**

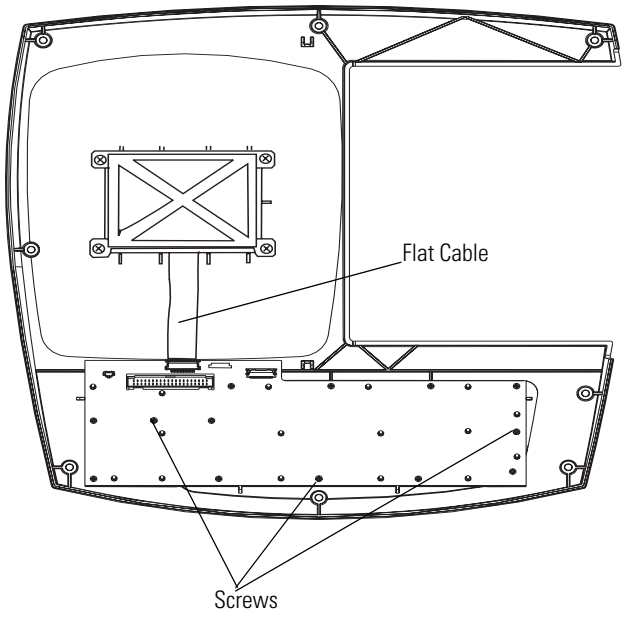
1. Open unit using the Disassembly Procedures (page 49) directions.
2. Disconnect the flat cable from the keyboard.
3. Remove the 13 screws holding in the keyboard assembly.
4. Gently lift out the keyboard assembly.

Reassembly Note

1. Install and tighten the 3 screws first (shown in Figure 58) to align the keyboard.

   DO NOT tighten the screws past the specified torque.
2. Install remaining 10 screws using the specified torque.

**Figure 58. Replacing the Keyboard Assembly (CP 100)**



# 6 Field Replaceable Parts

## Introduction

The field replaceable parts list is intended as a guide for ordering parts for both the CP 100 and CP 200 Electrocardiographs along with the optional Cart. The list is organized, by assembly, with all parts to that assembly listed including quantity per assembly.

**Note** Hardware pieces such as screws, washers, bearings, nuts, setscrews, and some labels may only be available in kits. However, all such pieces are listed with sizes, in the description, to allow for possible purchase from your local hardware store.

"For information about any Welch Allyn product, please call Welch Allyn Technical Support:" on page ii. or www.welchAllyn.com/medical/support.

# Field Replacement Parts

**Table 7. MISCELLANEOUS PARTS LISTING**

| Part Number | Description | Quantity |
|---|---|---|
| 703247 | SCREW, 6-32 X 375LG PHPS, V (Housing) | 8 |
| 76400 | POWER CORD, DETACH.(DOM/JAPAN) | 1 |
| 76402 | POWER CORD, DETACH.(EUROPEAN) | 1 |
| 76404 | POWER CORD, DETACH.(UK) | 1 |
| 76406 | POWER CORD, DETACH.(AUSTRALIA) | 1 |
| 761076-8 | POWER CORD, DETACH.(SWISS) | 1 |
| 761076-9 | POWER CORD, DETACH.(SOUTH AMERICA) | 1 |
| 761076-20 | POWER CORD, DETACH.(SOUTH AFRICA) | 1 |
| 701586 | DUST COVER, CP 100/CP 200 | 1 |
| 701557 | DIRECTIONS FOR USE MANUAL, CP 200, English (All languages available on CD) | 1 |
| 401151 | CP 200 PRODUCT INFORMATION CD | 1 |
| 703228 | DIRECTIONS FOR USE, CP 100, ENGLISH (Other languages available on CD) | 1 |
| 401150 | CP 100 PRODUCT INFORMATION CD | 1 |
| 401126 | ECG PATIENT LEAD CABLE, AHA, CP 100/200 | 1 |
| 401127 | ECG PATIENT LEAD CABLE, IEC, CP 100/200 | 1 |
| 401128 | ECG PATIENT LEAD CABLE, IEC, Vac, CP 100/200 | 1 |
| 401129 | LEADWIRE SET(10),AHA,BANANA,CP 100/200, W/COMB | 1 |
| 401122 | LEADWIRE SET(10),IEC,BANANA,CP 100/200, W/COMB | 1 |
| 401123 | LEADWIRE SET(10),AHA,PINCH,CP 100/200, W/COMB | 1 |
| 401124 | LEADWIRE SET(10),IEC,PINCH,CP 100/200, W/COMB | 1 |
| 703401 | CABLE COMB (LEAD SEPERATER) | 1 |

**Table 8. ASSEMBLY, BASE CP 100/200**

| Part Number | Description | Quantity |
|---|---|---|
| 703511 | HOUSING, CP 100/CP 200 BASE | 1 |
| 101-0038 | GROUND PLUG, 6/25 | 1 |
| 620198 | FOOT | 4 |
| 106124-4 | SCREW 4-20.250 PAN PHILLIPS | 9 |
| 236732 | IEC CONNECTOR | 1 |
| 236733 | FUSE DRAWER | 1 |
| 703611 | EOS MVLT80-1001-S77 PWR SUPPLY | 1 |
| 703774 | FERRITE, FLAT CABLE SNAP-ITS | 1 |
| 104-0007 | WASHER, FLAT | 1 |
| 104-0008 | WASHER LOCK SERRATED | 4 |
| 102-0001 | NUT HEX | 2 |
| 401370 | BATTERY ASSEMBLY, CP 100/CP 200 | 1 |
| 704064 | BATTERY FUSE, ZEUS PC5-6 | 1 |
| 700015 | BATTERY DOOR, CP 100/CP 200 | 1 |
| 703247 | PHPS 6-32 X.375 (Battery Door) | 2 |
| 704068 | HARNESS, INCOMING PWR (W001) | 1 |
| 704067 | HARNESS, GROUND POWER SUPPLY (W003) | 1 |
| 700157 | HARNESS, PWR SUPPLY TO MAIN PCB (W002) | 1 |
| 704221 | HARNESS, BATTERY (W008) | 1 |
| 700152 | HARNESS, MAIN PCB TO KEYBOARD (W014) | 1 |
| 455508 | LABEL, PROTECTIVE EARTH GROUND | 3 |
| 703922 | FUSE, 250V, 5 X 20MM, TIME LAG | 2 |

**Table 9. ASSEMBLY PRINTER, CP 100/200**

| Part Number | Description | Quantity |
|---|---|---|
| 700007 | AUX PAPER COVER, CP 100/CP 200 | 1 |
| 700012 | PAPER TRAY , CP 100/CP 200 | 1 |
| 703258 | SCREW M3 X 6 PHP FH, V | 2 |
| 700117 | SPRING, PRINT HEAD | 1 |
| 700118 | SHOULDER SCREW M3 X .5 | 2 |
| 703246 | SCREW, M3 X 0.5, PAN PHILLIPS | 8 |
| 106137-1 | NUT,4-40X.250 HEX,KEPS EXTLOCK | 1 |
| 700160 | HARNESS, GROUND PRINT HEAD (W005) | 1 |
| 700161 | HARNESS, PAPER DETECTION (W006) | 1 |
| 700162 | HARNESS, PRINT HEAD (W007) | 1 |

**Table 9. ASSEMBLY PRINTER, CP 100/200**

| Part Number | Description | Quantity |
|---|---|---|
| 700159 | BRUSH ANTI-STATIC 90mm FLEXIBLE | 2 |
| 700089 | PRINT HEAD ROHM, CP 100/CP 200 | 1 |
| 700001 | PRINT HEAD MOUNT, CP 100/CP 200 | 1 |
| 700002 | PAPER GUIDE, CP 100/CP 200 | 1 |
| 400044 | ASSY, GEAR BOX, CP 100/CP 200 | 1 |
| 700087 | STEPPER, MINEBEA, PM351-048-USG9 | 1 |
| 400053 | ASSY, QUE SENSOR (PCBA) | 1 |

**Table 10. ASSEMBLY, PAPER TRAY COVER, CP 100/200**

| Part Number | Description | Quantity |
|---|---|---|
| 700016 | PAPER TRAY COVER, CP 100/CP 200 | 1 |
| 700092 | PLATEN ROLLER | 1 |
| 700088 | GEAR, PINION 22 TOOTH, CP 100/CP 200 | 1 |
| 700093 | SHAFT, PRINTER DOOR LATCH | 1 |
| 700094 | BEARING, .187ID X .375 OD X .125 | 4 |
| 700095 | SPACER, .187ID X .25 OD X .063 | 3 |
| 700098 | SPRING, PRINTER DOOR | 1 |
| 700004 | RETAINER, PRINTER DOOR LATCH SHAFT | 2 |
| 700099 | CURVED WASHER, .187 ID X .25 OD X .006 | 1 |
| 700100 | SPACER, .187ID X .25 OD X .125 (SPRING) | 1 |
| 703246 | SCREW, M3 X 0.5, PAN PHILLIPS | 4 |
| 700091 | SCREW, SET CUP POINT , M2.5 X 4mm LONG | 1 |
| 700017 | LATCH, RELEASE | 1 |
| 700156 | RETAINING RING 3/16 | 2 |
| 700126 | LABEL, QUICK GUIDE, ENGLISH, CP 200 | 1 |
| 703875 | LABEL, QUICK GUIDE, DANISH, CP 200 | 1 |
| 703873 | LABEL, QUICK GUIDE, DUTCH, CP 200 | 1 |
| 703858 | LABEL, QUICK GUIDE, FRENCH CP 200 | 1 |
| 703859 | LABEL, QUICK GUIDE, GERMAN, CP 200 | 1 |
| 703871 | LABEL, QUICK GUIDE, ITALIAN, CP 200 | 1 |
| 703872 | LABEL, QUICK GUIDE, NORWEGIAN, CP 200 | 1 |
| 703876 | LABEL, QUICK GUIDE, PORTUGUESE, CP 200 | 1 |
| 703870 | LABEL, QUICK GUIDE, SPANISH, CP 200 | 1 |
| 703874 | LABEL, QUICK GUIDE, SWISS, CP 200 | 1 |
| 701774 | LABEL, QUICK GUIDE, ENGLISH, CP 100 | 1 |
| 703856 | LABEL, QUICK GUIDE, DANISH, CP 100 | 1 |

**Table 10. ASSEMBLY, PAPER TRAY COVER, CP 100/200**

| Part Number | Description | Quantity |
|---|---|---|
| 703854 | LABEL, QUICK GUIDE, DUTCH, CP 100 | 1 |
| 703847 | LABEL, QUICK GUIDE, FRENCH CP 100 | 1 |
| 703850 | LABEL, QUICK GUIDE, GERMAN, CP 100 | 1 |
| 703852 | LABEL, QUICK GUIDE, ITALIAN, CP 100 | 1 |
| 703853 | LABEL, QUICK GUIDE, NORWEGIAN, CP 100 | 1 |
| 703857 | LABEL, QUICK GUIDE, PORTUGUESE, CP 100 | 1 |
| 703851 | LABEL, QUICK GUIDE, SPANISH, CP 100 | 1 |
| 703855 | LABEL, QUICK GUIDE, SWISS, CP 100 | 1 |

**Table 11. ASSEMBLY, TOP COVER, CP 200**

| Part Number | Description | Quantity |
|---|---|---|
| 704343 | HOUSING, CP 200, TOP | 1 |
| 700122 | DISPLAY, LCD, COLOR - 320 x 240 , 5.7" N, CP 200 | 1 |
| 700121 | GLARE SCREEN, CP 200 | 1 |
| 401462 | ASSY, QWERTY KEYBOARD, CP 200 | 1 |
| 401461 | ASSY, FUNCTION KEYPAD, CP 200 | 1 |
| 703680 | SCREW,TORX#2 x 1/4 PAN PLASTITE | 13 |
| 106124-4 | SCREW 4-20.250 PAN PHILLIPS | 5 |
| 700119 | INVERTER, LCD | 1 |
| 200076-1 | SCREW 0-40 .187 PAN TORX | 2 |
| 106140-3 | SCREW 4-40 .250 PAN PHILLIPS STEEL ZINC | 4 |
| 704232 | HARNESS, QWERTY BOARD TO LCD (W013) | 1 |
| 700079 | HARNESS, KEY BOARD TO KEYPAD BOARD(W012) | 1 |
| 700151 | HARNESS, INVERTER SUPPLY (W009) | 1 |
| 700730 | HARNESS, GRND LCD (W010) | 1 |
| 700124 | LABEL, QWERTY CP 200 | 1 |
| 703108 | LABEL, FKP, ENGLISH | 1 |
| 703152 | LABEL, FKP, DANISH | 1 |
| 703150 | LABEL, FKP, DUTCH | 1 |
| 703105 | LABEL, FKP, FRENCH | 1 |
| 701032 | LABEL, FKP, GERMAN | 1 |
| 703834 | LABEL, FKP, ITIALIAN | 1 |
| 703109 | LABEL, FKP, NORWEGIAN | 1 |
| 703153 | LABEL, FKP, PORTUGUESE | 1 |
| 703107 | LABEL, FKP, SPANISH | 1 |
| 703151 | LABEL, FKP, SWISS | 1 |

**Table 12. OPTION, SPIROMETER CP 200**

| Part Number | Description | Quantity |
|---|---|---|
| 703411 | DIRECTIONS FOR USE MANUAL, CP 200, SPIRO | 1 |
| 100627 | PRESSURE TUBING, CPWS, CP 200, 2m | 1 |
| 703480 | SYRINGE,CALIBRATION,3L,CPWS,CP 200,SPIRO | 1 |

**Table 13. ASSEMBLY, TOP COVER, CP 100**

| Part Number | Description | Quantity |
|---|---|---|
| 704342 | HOUSING, CP 100 TOP | 1 |
| 701588 | LCD POWERTIP 3.9, CP 100 | 1 |
| 701035 | 3.9 LCD BRACKET, CP 100 | 1 |
| 701521 | GLARE SCREEN, LIMITED, CP 100 | 1 |
| 401463 | ASSY, QWERTY KEYBOARD, CP 100 | 1 |
| 106124-4 | SCREW 4-20.250 PAN PHILLIPS | 4 |
| 700124 | LABEL, QWERTY, CP 100/CP 200 | 1 |
| 703680 | SCREW,TORX#2 x 1/4 PAN PLASTITE | 13 |

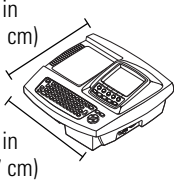
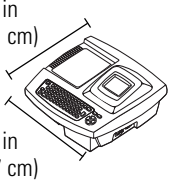
**Table 14. CART CP 100/CP 200**

| Part Number | Description | Quantity |
|---|---|---|
| 703129 | CAST BASE | 1 |
| 703133 | COLUMN EXTRUSION | 1 |
| 703131 | COLUMN ADAPTER | 1 |
| 703138 | SHELF, CART | 1 |
| 703139 | TOP PLATE, CART | 1 |
| 703443 | BASKET, CART | 2 |
| 703167 | SCREW, 1/4-20 x 1.50 PHP | 2 |
| 703160 | ADAPTER, PLASTIC CASTER, OFFICE | 4 |
| 703143 | CASTER, 5 IN TWIN WHEEL, OFFICE | 4 |
| 703144 | CASTER, FIXED 5 IN BRAKE, HOSPITAL | 2 |
| 703142 | CASTER, 5 IN, NO BRAKE, HOSPITAL | 2 |
| 703168 | SCREW, 1/4-20 x .75 FHP THREAD CUTTING | 4 |
| 106137-4 | NUT,10-32 EXTLOCK | 10 |
| 703169 | NUT, 1/4-20 EXTERNAL LOCK WASHER | 2 |
| 106100-6 | PHPS 6-32 X.375 | 6 |
| 703136 | HANDLE, CART | 4 |
| 703179 | ROLL PIN, 3/16 x .875 STL | 8 |
| 703135 | CORD WRAP | 1 |

**Table 14. CART CP 100/CP 200**

| Part Number | Description | Quantity |
|---|---|---|
| 703410 | SCREW, 10-32 x .312 PHP | 2 |
| 703130 | AUX TRAY | 1 |
| 703462 | NUT, T, 1/-4-20 | 2 |
| 703461 | TRILOBULAR KNOB 1/4-20 X .5 | 2 |
| 703454 | QUICK CONNECT, FLEX ARM | 2 |
| 703145 | FLEX ARM | 1 |
| 703137 | HOLSTER, FRONT END | 1 |
| 106100-56 | SCREW, 1/4-20 X 1.00 PAN HEAD PHILLIPS | 1 |
| 106106-4 | WASHER, LOCK, EXT 1/4 | 1 |
| 703510 | THUMB SCREWS, PKG | 1 |

# A Specifications

| Item | Specification |
|---|---|
| Dimensions | 16.2 in (41.1 cm)<br>  <br>6.2 in (15.7 cm)<br>15.6 in (39.7 cm)<br>16.2 in (41.1 cm)<br>  <br>6.2 in (15.7 cm)<br>15.6 in (39.7 cm) |
| Weight | 11.6 lb (5.3 kg) |
| Keyboard type | Elastomer keypad with complete alphanumeric keys<br>Soft-key menu and dedicated function keys (CP 200 Only) |
| Paper type | 8.25 x 11 inches (21 x 28 cm), Z-fold thermal paper, 200 sheets |
| Thermal printer (internal) | Computer-controlled dot array, 8 dots/mm |
| Thermal paper speeds | 10, 25, 50 mm/s |
| Gain settings: | |
| Auto ECGs | 5, 10, 20 mm/mV, AUTO |
| Rhythm ECGs | 5, 10, 20 mm/mV |
| Report print formats: | |
| Auto ECGs | 3x4, 3x4+ 1R, 3x4 +3R, 6x2, 12x1, 6x2 50 mm/s, 6x2 Ext. |
| Rhythm ECGs | 3, 6, or 12 leads at a time (CP 200) 3 leads at a time (CP 100) |
| Average cycles | 3x4 50 mm/s + 3R, 6x2 50 mm/s + 6R |
| ECG storage | Up to 50 ECGs (CP 200 Only) |
| Frequency range | 0.3 to 150 Hz |
| Digital sampling rate | > 1,000 samples/second/channel |
| Pacemaker detection | ANSI/AAMI EC11 |
| Power requirement | Universal AC power supply 100/240 V ~, 50/60 Hz ~, 2.2 A maximum |
| Fuses | |
| AC | Time-delay type, 2 amp 250 V rating, Littlefuse 0215002 or equivalent. |
| DC (battery fuse) | Fast-acting type, 10 amp 32 V rating, Bussman ATC-10 or equivalent. |

| **Item (Continued)** | **Specification (Continued)** | |
|---|---|---|
| Lead configurations | Standard, Cabrera | |
| Rechargeable battery | Lead acid gel, 6 volt, 5 AH<br>Prints up to 100 continuous ECGs per charge<br>12-hour recharging | |
| Filters | 0.5 Hz high-performance baseline filter<br>35 Hz muscle-tremor filter<br>AC-interference filter 50 Hz or 60 Hz | |
| Safety, EMC, and regulatory compliance | ANSI/AAMI EC11*<br>CAN/CSA C22.2 No. 601.1<br>CAN/CSA C22.2 No. 601.1.1<br>CAN/CSA C22.2 No. 601.1.2<br>CAN/CSA C22.2 No. 601.1.4<br>CAN/CSA C22.2 No. 601.2.25<br>AS/NZS CISPR 11 | UL60601-1<br>IEC/EN 60601-1<br>IEC/EN 60601-1-1<br>IEC/EN 60601-1-2<br>IEC/EN 60601-1-4<br>IEC/EN 60601-2-25 |
| Standard connectivity | Com port, SD memory card slot (for use with cards ≥ 64 MB) | |
| Connectivity with electronic medical records | Supported through the Welch Allyn CardioPerfect workstation software | |
| Electrodes | Rigorously tested for conductivity, adhesion, and hypoallergenic qualities, and exceed all AAMI standards | |
| Cables and wires | Meet or exceed IEC 60601 | |
| Environmental operating conditions:<br>Temperature<br>Relative humidity<br>Altitude | <br>+10° C to +40° C (+50° F to +104° F)<br>15 – 95% noncondensing<br>700 – 1060 hPa | |
| Environmental storage conditions:<br>Temperature<br>Relative humidity<br>Altitude | <br>-20° C to +49° C (-4° F to +120° F)<br>15 – 95% noncondensing (30 – 70% for printing)<br>500 – 1060 hPa | |
| Protection against electric shock | Class I, internally powered<br>Type CF | |
| Protection against ingress of water, per IEC 60529:<br>Electrocardiograph<br>Spirometry Component | <br>IPXØ<br>IPXØ | |
| Mode of operation | Continuous | |

*Per AAMI EC11:1991/(R)2001 Diagnostic Electrocardiographic Devices, Section 3.1.2.1 Disclosure of cautionary information/ performance characteristics paragraph c) Accuracy of input signal reproduction, the manufacturer shall disclose the methods used to establish overall system error and frequency response. Welch Allyn has used methods A & D, as prescribed in section 3.2.7.2 and 4.2.7.2 of this same standard, to verify overall system error and frequency response. Because of the sampling characteristics and the asynchronism between sample rate and signal rate, digital ECG systems such as the CP 100 and CP 200 may produce a noticeable modulating effect from one cycle to the next, particularly in pediatric recordings. This phenomenon is not physiologic.

Specifications are subject to change without notice.

# B EMC Guidance and Manufacturer's Declarations

**Table 15. Electromagnetic Emissions**

The electrocardiograph is intended for use in the electromagnetic environment specified below. The customer or user of the electrocardiograph should assure that it is used in such an environment.

| Emissions Test | Compliance | Electromagnetic Environment - Guidance |
|---|---|---|
| RF emissions<br><br>CISPR 11 | Group 1 | The electrocardiograph uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment. |
| RF emissions<br><br>CISPR 11 | Class A | The electrocardiograph is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes. |
| Harmonic emissions<br><br>IEC 61000-3-2 | Class A | |
| Voltage fluctuations/ flicker emissions<br><br>IEC 61000-3-3 | Complies | |

### Table 16. Electromagnetic Immunity

The electrocardiograph is intended for use in the electromagnetic environment specified below. The customer or user of the electrocardiograph should assure that it is used in such an environment.

| Immunity Test | IEC 60601 Test Level | Compliance Level | Electromagnetic Environment - Guidance |
|---|---|---|---|
| Electrostatic discharge (ESD)<br><br>IEC 61000-4-2 | ± 6 kV contact<br><br>± 8 kV air | ± 6 kV contact<br><br>± 8 kV air | Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%. |
| Electrical fast transient/ burst<br><br>IEC 61000-4-4 | ±2 kV for power supply lines<br><br>±1 kV for input/output lines | ±2 kV for power supply lines<br><br>Not applicable | Mains power quality should be that of a typical commercial or hospital environment. |
| Surge<br><br>IEC 61000-4-5 | ±1 kV differential mode<br><br>±2 kV common mode | ±1 kV differential mode<br><br>±2 kV common mode | Mains power quality should be that of a typical commercial or hospital environment. |
| Voltage dips, short interruptions, and voltage variations on power supply input lines.<br><br>IEC 61000-4-11 | >95% dip in 0.5 cycle<br><br>60% dip in 5 cycles<br><br>30% dip for 25 cycles<br><br>>95% dip in 5 seconds | >95% dip in 0.5 cycle<br><br>60% dip in 5 cycles<br><br>30% dip for 25 cycles<br><br>>95% dip in 5 seconds | Mains power quality should be that of a typical commercial or hospital environment. If the user of the electrocardiograph requires continued operation during power mains interruptions, it is recommended that the electrocardiograph be powered from an uninterruptible power supply or battery. |
| Power frequency (50/60Hz) magnetic field<br><br>IEC 61000-4-8 | 3 A/m | 3 A/m | Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment. |

### Table 17. Electromagnetic Immunity

The electrocardiograph is intended for use in the electromagnetic environment specified below. The customer or user of the electrocardiograph should assure that it is used in such an environment.

| Immunity Test | IEC 60601 Test Level | Compliance Level | Electromagnetic Environment - Guidance |
|---|---|---|---|
| | | | Portable and mobile RF communications equipment should be used no closer to any part of the electrocardiograph, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.<br><br>**Recommended separation distance** |
| Conducted RF<br>IEC 61000-4-6 | 3 Vrms<br>150 kHz to 80 MHz | 3 Vrms | $d = (1.17)\sqrt{P}$ |
| Radiated RF<br>IEC 61000-4-3 | 3 V/m<br>80 MHz to 2.5 GHz | 3 V/m | $d = (1.17)\sqrt{P}$ 80 MHz to 800 MHz<br><br>$d = (2.33)\sqrt{P}$ 800 MHz to 2.5 GHz<br><br>where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and *d* is the recommended separation distance in metres (m).<br><br>Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,[a] should be less than the compliance level in each frequency range.[b]<br><br>Interference may occur in the vicinity of equipment marked with the following symbol:<br><br> |

Note 1: At 80 MHz and 800 MHz, the higher frequency range applies.

Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

[a] Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the electrocardiograph is used exceeds the applicable RF compliance level above, the electrocardiograph should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the electrocardiograph.

[b] Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

### Table 18. Recommended Separation Distances Between Portable and Mobile RF Communications Equipment and the Electrocardiograph

The electrocardiograph is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or user of the electrocardiograph can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the electrocardiograph as recommended below, according to the maximum output power of the communications equipment.

| | **Separation Distance According to Frequency of Transmitter (m)** | | |
|---|---|---|---|
| **Rated Max. Output Power of Transmitter (W)** | **150 kHz to 80 MHz** $d = (1.17)\sqrt{P}$ | **80 MHz to 800 MHz** $d = (1.17)\sqrt{P}$ | **800 MHz to 2.5 GHz** $d = (2.33)\sqrt{P}$ |
| 0.01 | 0.117 | 0.117 | 0.233 |
| 0.1 | 0.37 | 0.37 | 0.74 |
| 1 | 1.17 | 1.17 | 2.33 |
| 10 | 3.70 | 3.70 | 7.37 |
| 100 | 11.70 | 11.70 | 23.30 |

For transmitters rated at a maximum output power not listed above, the recommended separation distance *d* in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

Note 1: At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

# C Software Updates

**Caution** Do not unplug or turn unit off during this process. It will cause the system to be inoperable.

**Note** You cannot uninstall updates made to the unit.

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## Procedure

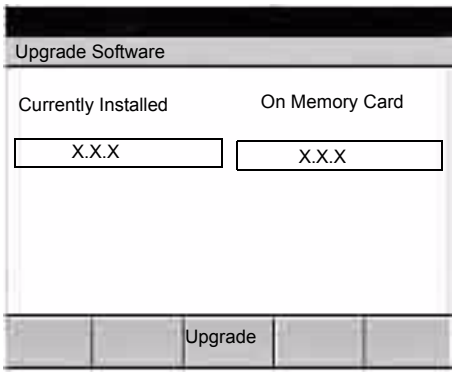
1. Power ON unit.
2. Insert the SD memory card into the slot on the unit.
3. Press Menu key.
4. Choose **Main Menu** > **Systems Settings**> **Device Info** > **Upgrade Software**

   The Upgrade Software screen appears. See Figure 59.
5. Press the "Upgrade" Softkey button.
   The upgrade takes approximately 60 seconds to complete.The unit will reboot.
6. Reset the Date and Time on the unit after it reboots. See the *Directions for Use* manual.

**Verify Update**

1. Choose **Main Menu** > **System Settings** > **Device Info** > **Print Setting**.
2. Compare product version to what was installed.

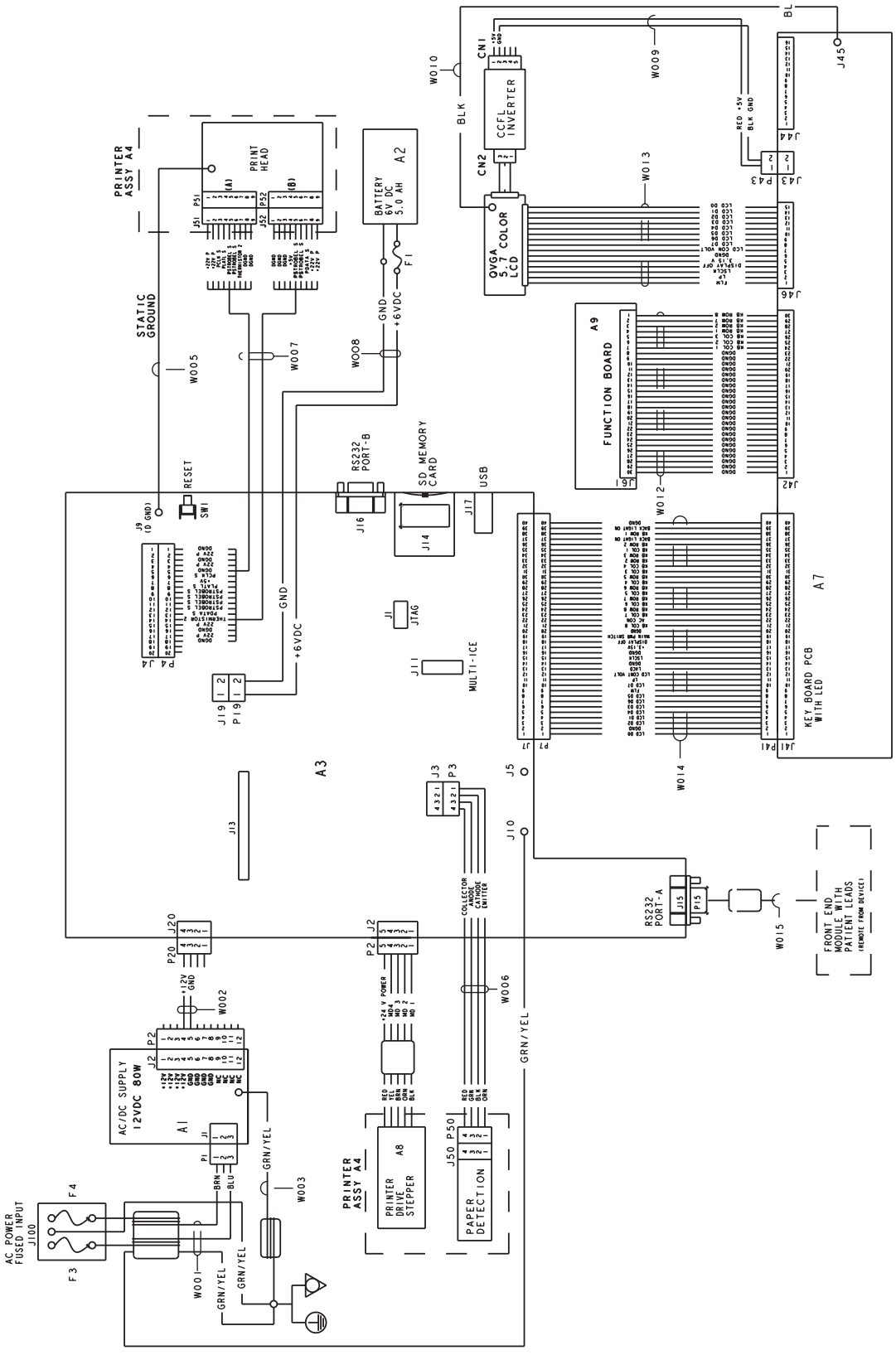
**Figure 59. CP 200 "Software Upgrade" Screen**



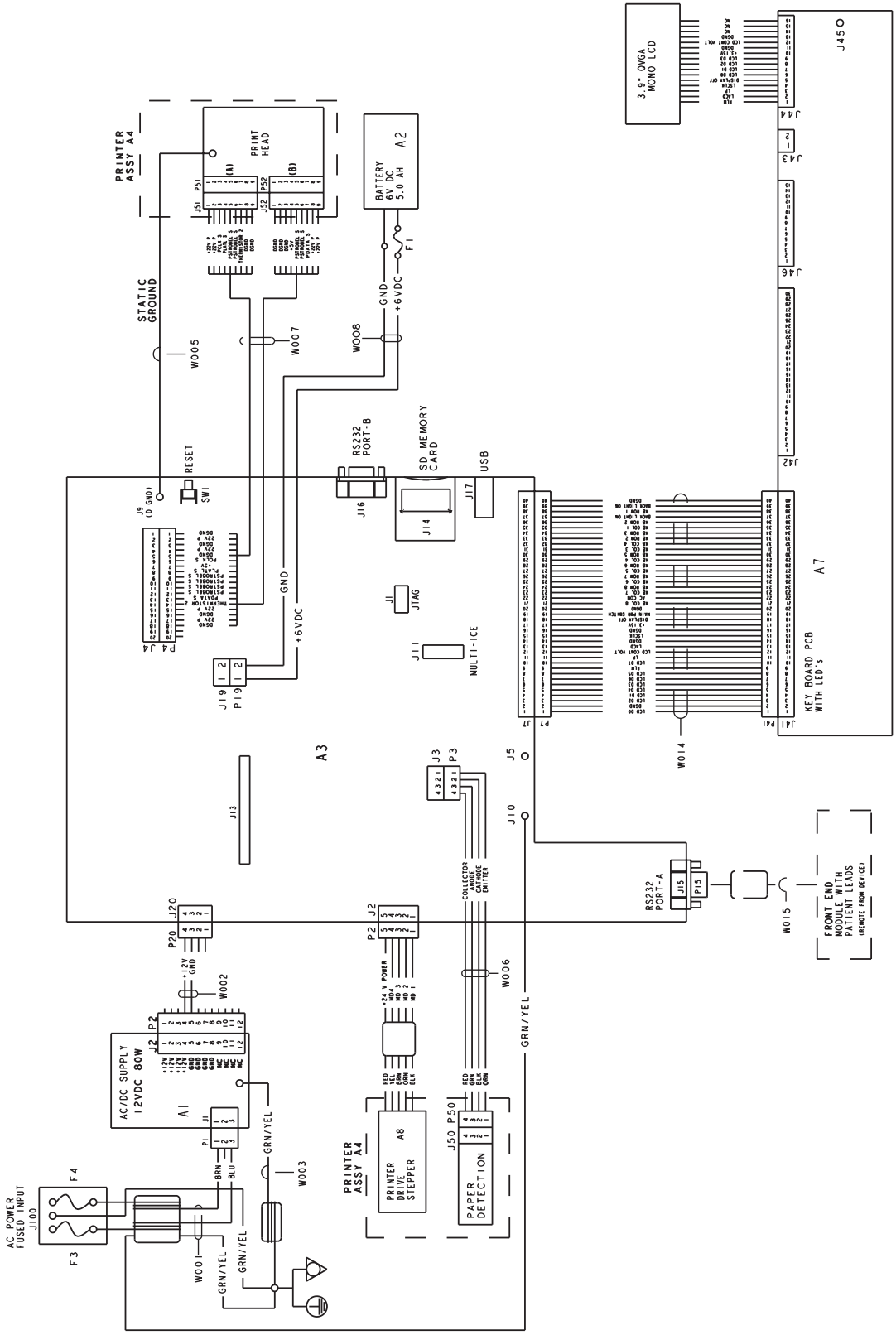
# D Interconnect Diagrams

CP 200 Interconnect Diagram . . . . . 86
CP 100 Interconnect Diagram . . . . . 87

# CP 200 Interconnect Diagram



# CP 100 Interconnect Diagram



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